FOOD AWAY FROM HOME CONSUMPTION IN URBAN CHINA: HOUSEHOLD COMPOSITION AND DINING LOCATION EFFECTS

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ABSTRACT

China has experienced dramatic changes in food industry in the last three decades, with demographics changed substantially as well. Households are becoming smaller and are expected to age soon. Overweight and obesity have become serious problems at all ages and are worsening rapidly. All these demographic changes are closely related to food consumption and are going to play a vital role on the future of food industry, especially Food-away-from-home (FAFH) consumption.

This study intends to analyze food away from home consumption in urban China with respect to household composition and income first, and then examine the influences of dining location away from home on adult obesity. Findings indicate that household composition has significant effects on FAFH participation and expenditure, and different age groups have different influences. Cafeteria is the most often place urban Chinese have meals at and such meals increase the likelihood of consumers being overweight and obese.

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1. INTRODUCTION

1.1. Problem Statement

China became the second largest economy in 2011 and can be expected to surpass the U.S. economy as the world's biggest economy around 2016 according to OECD (Zachary Keck, 2013). China's national GDP exceeded 47,288 billion Yuan in 2011 compared to only 455 billion Yuan in 1980, an increase of more than 100 times. At the same time, per capita GDP increased from 463 Yuan to 35,181 Yuan. Excluding inflation, the per capita annual disposable/net income in 2011 for both urban and rural households was more than ten times that in 1980. In addition, the process of urbanization has been speeding up ever since 1980. In 2011, more than half the national population lived in urban areas (NBSC, 2012), and it is expected to increase to around 70% by 2050 (UN, 2011).

Current household composition in China is very different from that in 1980. Due to the "one couple one child" policy, the average family household size decreased to 3.02 in 2011 from more than 4.41 in 1980 (NBSC, 2011, NBSC, 2012), which suggests that the traditional multiple generation families are disappearing. Besides, China is rapidly aging. The old dependency ratio (the number of people 65 years or older divided by the number of people that are between 15 and 64) grew to 12.3% in 2011 and the children dependency ratio decreased to 22.1% (NBSC, 2012), and the society is expected to continue aging if current policy remains unchanged.

In addition to an aging society, obesity has become another serious problem in China. On average, 38.5 percent of China's 2010 population had a body mass index (BMI) greater than or equal to 25. This was a sharp increase from the 2002 statistic of 25.1 percent and is estimated to continue increasing to 48.4 percent by2015. Moreover, the overall obesity prevalence for those 15 years old and above in 2015 is estimated to be twofold the rate in 2010, or from 3.8% to

7.6%. For adults between 30 and 100 years old, males are expected to become more obese than females by 2015 (Ono T, et al., 2005).

Dining away from home has become a common phenomenon in China and is more popular in the urban areas. Food away from home (FAFH) made up 21.5% of total food expenditure for an average urban household in 2011, while that ratio in 1995 was only 9.8% (NBSC, 2012). In addition to eating away from home more often, many consumers' diets have transitioned from a low-fat traditional diet to one that is perceived to be more western and is centered on animal products, edible oil and processed food. Multiple newspapers have reported that western fast food restaurants are booming in China and they lead to overweight and obesity (Barnard, 2012, Bruno, 2013, Patterson, 2011).

Household composition has been shown to have significant effects on food consumption, particularly on FAFH consumption (Byrne, et al., 1996, Lee and Brown, 1986, Mutlu and Gracia, 2006, Nayga, 1996, Prochaska and Schrimper, 1973, Yen and Jones, 1997), but there are limited studies on Chinese household composition. FAFH itself has been confirmed to be a cause of overweight and obesity (Binkley, et al., 2000, Bowman, et al., 2004, Dunn, et al., 2012, Fraser and Edwards, 2010, Guthrie, et al., 2002, Mancino, et al., 2009, Naska, et al., 2011), but limited attention was on the influences of FAFH dining locations. Therefore, this study focuses on food away from home consumption and household composition along with obesity in various cities throughout urban China.

1.2. Objectives

The overall objective of this research is to analyze food away from home consumption in urban China from the perspective of both expenditure and quality by separating the study into two parts. The first study focuses on how household composition and income affect food away

from home consumption through both participation and expenditure. The second study investigates adult overweight and obesity and focuses on the effect of food away from home dining locations. The specific objectives of this study are as the follows:

1) First descriptively analyze FAFH participation and expenditure, as well as urban household composition by grouping age as 0-14, 15-29, 30-39, 40-49, 50-64, 65 and over. Then, employing a Box-Cox Double-Hurdle model, empirically estimate the effect of household composition and income on FAFH consumption. Further, projections of FAFH expenditure are brought forth using our own estimates and population forecasts of each age group from the United Nations.
2) Adult BMI, overweight and obesity prevalence are analyzed with a description of FAFH dining locations following by. Then a linear model and Ordered Probit model are estimated to examine the influence of food dining locations on weight problems by measuring weight both as interval data and categorical data respectively. Moreover, the marginal effects from the Ordered Probit model are calculated to give more explicit analysis.

1.3. Organization

This thesis is organized into five chapters. Previous studies about food away from home consumption, household composition, and food dining location and overweight and obesity are reviewed in Chapter 2. Chapter 3 is a separate study that focuses on how household composition and income affects FAFH consumption and projects FAFH expenditure until 2050. Chapter 4 is also a separate study which focuses on where urban Chinese eat when dining out of home and the different dining locations affect adult overweight and obesity. Finally, Chapter 5 ties it all together and provides an overall summary of our major findings.

2. LITERATURE

2.1. Food-Away-From-Home Consumption

Food-Away-From-Home (FAFH) consumption was first studied in the U.S., and most of the existing research is focused on U.S. citizens, although it has been noticed in other societies recently as well. Socio-economic and demographic effects on FAFH expenditure and consumption are frequently examined, and the major factors are income, household size, education, sex, urbanization, race and region (Byrne, et al., 1996, Kinsey, 1983, Lee and Brown, 1986, McCracken and Brandt, 1987, Nayga, 1991, Prochaska and Schrimper, 1973).

Besides the general research on FAFH consumption, some researchers start to explore the issue more specifically. Yen (1993) focuses on the effects of working wives on households' FAFH consumption. His results show that wife's employment or time value is positive, which is consistent with lots of previous studies (Bellante and Foster, 1984, Kinsey, 1983, McCracken and Brandt, 1987, Prochaska and Schrimper, 1973, Soberon-Ferrer and Dardis, 1991). The positive effect of income on FAFH consumption is consistent with the literatures (Bellante and Foster, 1984, Soberon-Ferrer and Dardis, 1991).

In addition, Mihalopoulos and Demoussis (2001) analyze the FAFH consumption in Greece. They find significant and positive effects of adult household size, education and employment status of meal planners, also of urbanization. However, they show that if urban households dine out, they would spend less money than their rural counterparts. Mutlu and Gracia (2006) investigate Spanish expenditures on breakfast, lunch and snacks away from home, and confirmed the positive effects of income and labor time of women. Bezerra, et al. (2013) describe food consumed away from home among people aged above 10 years in Brazil using a one-day national dietary survey in 2008-2009. They find that 40% of the sample reported FAFH

consumption, with the elderly in the Midwest region having the lowest participation rate (13%) and adolescents in the Southeast having the highest participation probability (51%). In urban areas, their sample shows that people owning higher income and being male consumes more often outside.

Focusing on China, Min, et al. (2004) investigate FAFH expenditure patterns in China through a comparison between year 1992 and 1998. Positive effect of income is found but much larger than that for the United States. Ma, et al. (2006) describe the FAFH consumption trends between 1995 and 2001, and examine the determinants of FAFH demand by food category using their own collected survey data. Major results are consistent with studies in other countries. Gould and Villarreal (2006) present a comprehensive analysis of total food expenditures on urban Chinese. As expected, household income is a primary determinant of FAFH and FAH allocation, and the share of total food expenditures associated with FAFH increases as income increases.

Recently, Bai, et al. (2010) analyze the effects of wealth, time and free meals on FAFH consumption for citizens in Beijing. Their key findings suggest that excluding hosted meals which are not paid by individual consumers themselves would underestimate household expenditure on FAFH, and it comprised nearly one half of the underestimation. As to household size, a positive effect on both the participation and expenditure of FAFH was found in Beijing when the meals were disaggregated by type of facility and meals; large size households dine out more often for lunch and dinner (Bai, et al., 2012). They also find the presence of children under 16 years old significantly negatively affect the participation of FAFH in both models.

2.2. Household Composition, Income and FAFH Consumption

Income is almost firstly thought to be the cause of increasing FAFH consumption and developing food distribution. Higher income brings higher FAFH consumption in both the probability of consuming and the quantity or expenditure. This has been found in aforementioned numerous studies.

International evidences indicate that structural changes in population significantly influence food consumption, especially on food away from home (FAFH) consumption (Nayga, 1996, Prochaska and Schrimper, 1973). Lee and Brown (1986) create 12 household composition variables and find U.S. 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, et al. (1996) construct 11 adult equivalence terms and find household composition affects U.S. FAFH consumption patterns. Younger members expend less on FAFH than adults, but their expenditures 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 only have significant and positive effects on cheese consumption. Using five categories, Su and Yen (1996) find all age composition variables have significant and positive effects on both the probability of spending on pork and the level of pork consumption, but the size of the effects differs by age categories with those in the 20-44 age category having the greatest effect.

Disaggregating consumption by type of meals, Mutlu and Gracia (2006) investigate Spanish household FAFH expenditure and find that household size significantly increases the probability and expenditure of breakfast consumption away from home, but it has a negative effect on lunch consumption. Also, the percentage of children aged 0-6 has no significant

influence on the FAFH consumption for any type of meals. However, for rural Ghana, an additional child three years old or younger increases fresh vegetable expenditures, but an additional family member above 61 years of age has the opposite effect (Meng, et al., 2012). Additional studies also indicate that household composition significantly determines FAFH consumption in other countries (Hossain and Jensen, 1994, Meenakshi and Ray, 1999, Mihalopoulos and Demoussis, 2001, Schipmann and Qaim, 2011).

2.3. FAFH Dining Location and Overweight and Obesity

Abundant research goes beyond the determinants of FAFH consumption to the effects and consequences of it, and a consensus has been achieved that dining away from home negatively affect consumers' health. Based on the USDA 1994–96 Continuing Survey of Food Intakes by Individuals (CSFII), Binkley, et al. (2000) try to determine whether the food preparation location has contributed to the increased obesity of US population. They find both restaurants and fast food outlets have significant and positive effect on the BMI for adult males, but only fast food significantly causes obesity for adult females. Upon same database, Binkley (2008) compares the grams and calories of breakfast, lunch, and dinner of fast food and table service meals for adults (age>18), teenagers (12<age<19), and children (age<13). The results indicate that both are larger and have more calories than meals prepared at home, with table service exceeding fast food. However, both result in similar calorie increase compared with no FAFH through a whole day, and fast food is somewhat worse. This coincidental relationship between FAFH consumption and higher BMI has been observed frequently (Bowman, et al., 2004, Dunn, et al., 2012, Fraser and Edwards, 2010, Guthrie, et al., 2002, Mancino, et al., 2009, Naska, et al., 2011).

Dunn, et al. (2012) show that the distance to the nearest fast-food restaurant and the number of fast-food restaurants within 1 mile and 3 miles of a participant's residence is positively correlated with both the frequency of consuming fast food meals and obesity risk for non-white rural residents in central Texas, although no significant relationship was found for whites. To address the endogeneity problem of fast-food availability, the distance between residence and the nearest major roadway connecting major metropolitan areas is used as an instrument, which was employed by Dunn (2009), (2010) and Anderson and Matsa (2011) previously. Besides, a European study indicates that eating at restaurants and similar establishments which include cafeterias, bars or fast food outlets was positively associated with BMI and weight change (Naska, et al., 2011).

Focusing on children, Poti and Popkin (2011) aims to examine the trends in daily energy intake by US children for foods eaten at home and away from home by source of preparation. Results show that increased energy intake (+179 kcal/day) by children during 1977-2006 was associated with a major increase in energy taken away from home (+255 kcal/day). Fast food outlets surpass schools becoming the largest FAFH energy provider for all children age groups. Similarly, Tin, et al. (2012) investigate the association between breakfast eating location and body mass index change of primary fourth grade students in Hong Kong 1998-2000. They find both breakfast skipping and eating breakfast away from home predict greater increases in BMI during childhood, the effect being slightly stronger in the latter.

However, among the large body of literatures, we rarely see studies that specially focus on the relationship between food eating/preparation location and adult obesity in Chinese cohorts. Given the 1.4 billion population, 51.7% urbanization rate and the world's second largest economy on one hand, and rapid societal aging, increasingly corpulent community, unabated

admiring of western culture on the other hand, FAFH can be expected to continue growing in years to come, food industry get even prosperous, while China is going to experience difficult times on the way to develop further. Provided of such significance and the paucity of related research, this study intends to describe current FAFH consumption and obesity in urban China, analyzes the effect of household composition on FAFH consumption together with income, and investigates how FAFH consumption affects urban Chinese body mass index for groups aged 18 years and above.

3. HOUSEHOLD COMPOSITION, INCOME, AND FOOD-AWAY-FROM-HOME CONSUMPTION IN URBAN CHINA

3.1. Introduction

China, the world's most populace country, has experienced dramatic socio-demographic and income changes in the last three decades. The proportion of people living in the urban areas of China has increased to over 50% in 2011 from 19.39% in 1980 according to the National Bureau of Statistics of China (NBSC) (2012). Rapid societal aging is another noticeable phenomenon. Currently, 12.3% of China's urban population is aged 60 or above, and it is expected to increase to 17.4% by 2020 and to 33.9% by 2050 (NBSC, 2012, UN, 2011). The unique "one couple one child" policy has decreased birth rates, and the population between 0 to 9 years old is expected to decline from 12.18% in 2010 to 8.23% in 2050 (UN, 2011). Additionally, China's traditional multiple generational families are disappearing with the average urban household size shrinking to 3.10 persons in 2010 from 4.0 in 1995(NBSC, 2011, NBSC, 1996).

China's GDP will continue to grow barring major world economic shocks. It is expected to expand at an annual rate of some 7.9% over the next ten years compared with the 2.8% in the United States (U.S.) and 1.7% in Germany (Atsmon, et al., 2012). If so, Chinese GDP will account for 19% of the world economy by 2020, compared with 9% in 2010. China's economy is also predicted to have significant structural change with growth being more driven by consumption rather than investment (Atsmon, et al., 2012).

International evidence indicates that the structural changes in population or household composition and income growth often have significant effects on food consumption, particularly on food away from home (FAFH) (Nayga, 1996, Prochaska and Schrimper, 1973). Lee and Brown (1986) create 12 household composition variables and find U.S. 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, et al. (1996) construct 11 adult equivalence terms and find household composition affects U.S. FAFH consumption patterns. Younger members expend less on FAFH than adults, but their expenditures 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 only have significant and positive effects on cheese consumption. Using five categories, Su and Yen (1996) find all age composition variables have significant and positive effects on both the probability of spending on pork and the level of pork consumption, but the size of the effects differs by age categories with those in the 20-44 age category having the greatest effect. Disaggregating consumption by type of meals, Mutlu and Gracia (2006) investigate Spanish household FAFH expenditure and find that household size significantly increases the probability and expenditure of breakfast consumption away from home, but it has a negative effect on lunch consumption. Also, the percentage of children aged 0-6 has no significant influence on the FAFH consumption for any type of meals. However, for rural Ghana, an additional child three years old or younger increases fresh vegetable expenditures, but an additional family member above 61 years

of age has the opposite effect (Meng, et al., 2012). Additional studies also indicate that household composition significantly determines FAFH consumption in other countries (Hossain and Jensen, 1994, Meenakshi and Ray, 1999, Mihalopoulos and Demoussis, 2001, Schipmann and Qaim, 2011).

FAFH consumption in China has increased rapidly in recent years from only 9.8% of China's total food expenditure in 1995 to 22.8% in 2010 (NBSC, 2011). It is also expected to grow quickly in the near future (Bai, et al., 2010, Min, et al., 2004). Unfortunately, evidence on the effects of household composition on China's FAFH is limited, and the evidence available is generally based on NBSC household data that undercounts FAFH consumption or on data that are not current (Bai, et al., 2010, Ma, et al., 2006). For example, Gould and Villarreal (2006) using 2001 NBS household data find that household composition significantly affects the share of FAFH to total food. Min, et al. (2004) using NBSC household data for 1992 and 1998 study the determinants of FAFH expenditure but do not address household composition. Ma, et al. (2006) using their own 1998 survey data find that young people consume more FAFH, particularly meat, but their study does not address household composition effects on FAFH consumption.

Given the growing importance in China of FAFH consumption and the paucity of research on this topic in China, the paper analyzes FAFH consumption including household composition and income effects utilizing a recent data set collected by the authors that account for FAFH consumption. Specifically, a double-hurdle model is fit to the data, coefficients are estimated, and, based on these, future FAFH consumption in

China are projected over the next four decades. The structure of the paper is as follows. The methodology of the paper is briefly discussed and followed by a descriptive analysis of the data. Empirical results are presented followed by a discussion of household composition and income effects on future FAFH expenditures that includes a projection of FAFH expenditure through 2050. Finally, we conclude with our major findings.

3.2. Methodology

The household decision to consume FAFH can be modeled as a two-step process. First, the household must decide whether or not to consume FAFH. This is considered to be the participation decision. For those household choosing not to dine out, FAFH expenditure will be zero. A second decision must be made by those that choose to dine out, that is, how much to spend or the expenditure decision. In estimating this process, it is important to explicitly model the two-step decision and to account for zero expenditure. Simply applying ordinary least squares to the expenditure equation will result in biased and inconsistent estimates (Amemiya, 1984).

To model the two-step decision, we choose a double-hurdle model that takes into account the interaction between the participation and expenditure decisions (Bai, et al., 2010, Yen, 1993, Yen and Jones, 1997, Yen and Huang, 1996). The model may be expressed as

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

where y_i is the observed expenditure, and y_{1i}^* and y_{2i}^* are two unobserved latent variables representing the participation hurdle and the expenditure hurdle, respectively. They are specified as linear functions of a set of hurdle regressors, $x_{1i}^{'}$ and $x_{2i}^{'}$. β_1 and β_2 are parameter vectors to be estimated, the error terms u_{1i} and u_{2i} are distributed as

$[u_{1i}, u_{2i}]' \sim \text{BVN}(0, \Sigma)$, $\Sigma = \begin{bmatrix} 1 & \rho\sigma_i \\ \rho\sigma_i & \sigma_i^2 \end{bmatrix}$, and the conditional distribution of the latent variables is bivariate normal. To account for the non-normal errors, a Box-Cox transformation is applied (Yen and Jones, 1997). The Box-Cox transformation (Poirier, 1978) is given by

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

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

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

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

To allow for heteroskedasticity, the standard deviation of errors σ_i is specified as

$$\sigma_i = w_i'\gamma, \tag{4}$$

where w_i is a vector of exogenous variables, and γ is the parameter vector. In this study, w_i is hypothesized to include total household income excluding wife's income and household size. Thus, normality, homoscedasticity, and independence of error terms can be statistically tested.

The dependent variable in the participation equation is whether or not the household consumed FAFH during the survey week, and the independent variable in the expenditure equation is weekly household FAFH expenditures. In the participation hurdle, the explanatory variables include household disposable income excluding wife's salary and its quadratic term, wife's education, whether the wife works or not, and city dummies. The expenditure hurdle function includes all variables in the participation hurdle plus two other variables: the number of FAFH visits on weekends, and the number of non-household members dining out with the household. By doing so, we measure the effects of weekends and social networks on household FAFH behavior (Byrne, et al., 1996). Additionally, to account for household composition, six household composition variables defined as the number of individuals aged between 0-14, 15-29, 30-39, 40-49, 50-64, 65+ in a household are included in both equations.

3.3. Data

The household data used in this study are collected by surveying 1,340 households in six Chinese cities (Beijing, Nanjing, Chengdu, Xi'an, Shenyang and Xiamen). The survey year and number of households are 2007 and 315 households for Beijing, 2009 and 246 households for Nanjing, and 2010 and 208 households for Chengdu. The data in the other three cities are collected in 2011 with the number of

households being 215 for Xi'an, 207 for Shenyang, and 149 for Xiamen. These cities are geographically dispersed in China, are relatively high income centers in their region, and have populations ranging from 2.52 million for Xiamen to 19.61 million for Beijing in 2010 (NBSC, 2011)(Xiamen Economic and Social Development Reports, 2010).

The households in our survey are selected by a stratified and random sampling approach from households participating in the Urban Household Income and Expenditure (UHIE) survey in each city. The UHIE survey is the primary official information on urban consumers' income and expenditures and is a primary data source of the published China Statistical Yearbooks. In our survey, selected households record each food item that is consumed by each household member, both at home and away from home, for an entire week. A drop-off and pick-up approach is applied. Detailed information on demographics and socio-economics of the household are also collected in the survey. See Bai, et al. (2012) for detailed information of the survey.

FAFH in our survey is defined to include most meals that are not prepared at home. It also includes FAFH consumption that is free, hosted by friends or relatives, or is provided by work units. Semi-processed or ready-to-eat food products that are purchased from food stores such as supermarkets or convenience stores are not included as FAFH. For purposes of analysis, participation in FAFH is based on positive FAFH expenditures.

Not all households participate in FAFH during the sample period. Overall, 83% of the households participate in the FAFH market. Beijing, the capital of China, has the highest participation rate at 88% while the participation rate in the other cities ranges

from 78% (Shenyang) to 84% (Xi'an) (Table 3.1). The average weekly expenditure for households that participate is 177 Yuan. Beijing is leading with average expenditure of 201 Yuan while Xiamen is the lowest at 144 Yuan.

Table 3.1. Weekly food-away-from-home consumption by city

City	HH consuming FAFH	Full sample	Truncated sample (positive expenditure)
		HH total expenditure	HH total expenditure
Total	83%	147	177
Beijing	88%	177	201
Nanjing	83%	144	172
Chengdu	82%	158	193
Xi'an	84%	140	167
Shenyang	78%	123	157
Xiamen	80%	115	144

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

The average household size of our sample is 2.91 and may be calculated by summing the means of age groupings reported in column 2 of Table 3.2 for the full sample. The average number of persons less than or equal to 14 years old is 0.31 while the average number of persons per household age 65 or greater is 0.29. The group with the largest average number of persons is the 50-64 group followed by the 40-49 group. Households with positive FAFH consumption have more members younger than 50 years and fewer members 50 years and above.

Table 3.2. Summary statistics of variables used in regression

Variable	Full sample		Reported FAFH expenditures	
	Mean	SD	Mean	SD
Age group				
# of HH members 0<=age<=14	0.31	0.49	0.33	0.49
# of HH members 15<=age<=29	0.49	0.57	0.55	0.58
# 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<=64	0.82	0.90	0.80	0.90
# of HH members age>=65	0.29	0.62	0.22	0.55
Income				
HH weekly disposable income (1,000 Yuan)	1.35	0.86	1.42	0.87
HH weekly disposable income excluding wife's wage (1,000 Yuan)	1.14	0.82	1.18	0.83
Controls				
Whether wife works in labor market (1=yes)	0.45	0.50	0.49	0.50
Wife's education(1=above high school)	0.35	0.48	0.38	0.49
# of Non-HH members FAFH	1.14	3.91	1.37	4.25
# of FAFH visits on weekends	1.84	2.17	2.22	2.20
City Dummy Omitted				
Observations	1340		1115	

Note: Household income is adjusted to 2010 base using national annual income indices.

Dependency ratio may be calculated from our urban sample. The old-age /child dependency ratio is the number of people 65 years or older / 0-14 divided by the number of people that are between 15 and 64 (UN, 2011). The old-age dependency ratio is 12.8 in our sample, and the child dependency ratio is 13.4. The former is larger than the officially-reported ratio of 11.9 for China as a whole, but the latter is smaller than the reported child dependency ratio of 22.3(NBSC, 2011). Because our sampled households are only from urban areas, these results are expected. Compared with countries at similar per capita GDP levels, China is not the most aged society, but has a higher percentage of population 65 years and over than some of the countries having higher income levels. The old-age dependency ratios in the U.S. and Japan in 2010 are 19.5 and 35.5, both greater than China's. As the per capita GDPs in these two countries are much higher than China's, about 10 times, this indicates that China's society is aging rapidly at a lower per capita GDP level than in the US or Japan.

The statistical descriptions of the other exogenous variables are also reported in Table 3.2. Weekly household disposable income excluding wife's salary is 1140 Yuan and 1180 Yuan in the full and truncated samples, respectively. Overall, 45% of the wives work in the labor market (including both full-time and part-time employment), but this number is 4% higher for households consuming FAFH during our survey periods. In terms of wife's education, 35% of them have an education level above high school. The average number of non-household members eating with household members away from home during a whole week is 1.14 for the full sample and 1.37 for

those reporting FAFH expenditure. The average number of weekend visits is 1.8 for dining out while during the rest of the week it is 7.9.

3.4. Empirical Results

The parameters and associated asymptotic standard errors of the model, equation (3), are estimated with maximum likelihood (ML) and reported in Table 3.3. The Box-Cox parameter lambda (λ) is significantly different from both zero and one at the 0.01 level indicating that the Box-Cox transformation is appropriate. The estimated rho (ρ) is also significant at the 0.01level, suggesting the participation and expenditure equations are not independent. The coefficients on household income excluding wife's income and household size in the sigma equation are statistically significant indicating the existence of heteroskedasticity. Accordingly, the ML estimator allows for unequal variances across households and the existence of dependence in the model in order to generate consistent estimates. The total or unconditional elasticity with respect to an independent variable can be decomposed into the elasticity of the probability of participation and the conditional elasticity of expenditure (Maddala, 1983, McDonald and Moffitt, 1980). These elasticities are calculated and reported in Table 3.4.

Household composition affects both participation and FAFH expenditure as indicated by the signs and significance levels of their estimated coefficients reported in Table 3.3. A noticeable pattern emerges for both equations. Households with younger children have a low but positive and insignificant probability of participating in FAFH, and their presence increases FAFH expenditures. Households with teenagers and adults up to age 39 are indicated to participate and spend more than other groups on FAFH.

Table 3.3. Maximum likelihood estimates of the Box-Cox double-hurdle model

	Coefficient		ASE[a]
Participation			
# of HH members 0<=age<=14	0.017		0.105
# of HH members 15<=age<=29	0.424	***	0.092
# of HH members 30<=age<=39	0.348	***	0.099
# of HH members 40<=age<=49	0.165	*	0.09
# of HH members 50<=age<=64	-0.034		0.083
# of HH members age>=65	-0.35	***	0.083
HH weekly disposable income (excluding wife's wages)	0.456	***	0.105
HH weekly disposable income, Squared	-0.044	***	0.012
Whether wife works in labor market (1=yes)	0.175		0.111
Wife's education(1=above high school)	0.182	*	0.102
Nanjing	0.029		0.141
Chengdu	-0.027		0.144
Xi'an	-0.044		0.143
Shenyang	-0.065		0.142
Xiamen	-0.208		0.156
Constant	0.222		0.196
Expenditure			
# of HH members 0<=age<=14	0.331	*	0.194

(continued)

Table 3.3. Maximum likelihood estimates of the Box-Cox double-hurdle model (continued)

	Coefficient		ASE[a]
Expenditure			
# of HH members 15<=age<=29	0.507	***	0.169
# of HH members 30<=age<=39	0.655	***	0.191
# of HH members 40<=age<=49	0.225		0.155
# of HH members 50<=age<=64	0.016		0.144
# of HH members age>=65	-0.73	***	0.188
HH weekly disposable income (excluding wife's wages)	1.461	***	0.292
HH weekly disposable income, Squared	-0.109	**	0.052
Whether wife works in labor market (1=yes)	0.749	***	0.204
Wife's education(1=above high school)	0.488	***	0.177
# of Non-HH members FAFH	0.119	***	0.022
# of FAFH visits on weekends	0.533	***	0.066
Nanjing	-0.606	**	0.245
Chengdu	-0.203		0.246
Xi'an	-1.241	***	0.284
Shenyang	-0.665	**	0.267
Xiamen	-1.386	***	0.324
Constant	5.029	***	0.418

(continued)

Table 3.3. Maximum likelihood estimates of the Box-Cox double-hurdle model (continued)

	Coefficient		ASE[a]
Sigma			
HH weekly disposable income (excluding wife's wages)	0.392	***	0.101
Household size	-0.032		0.061
Constant	2.131	***	0.277
Lambda	0.685	***	0.069
Rho	0.489	***	0.058

[a]Asymptotic standard errors, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Households with member 40-49 participate in FAFH more often but it doesn't significantly affect expenditure. No statistically significant effect is found on participation and expenditure from members in the group 50-64. The coefficients of both equations for seniors are negative and significantly different from zero. This is expected considering that seniors generally have more leisure time for cooking, and they are often more frugal and diligent than young people. Similar results are also found in previous studies by McCracken and Brandt (1987) and Yen (1993). These results indicate a life-span cycle. When a household has young children, they participate slightly more in eating out but do not spend that much when they do eat out. As the children become older, eating out becomes more attractive to the household. Households with teenagers and young adults participate more frequently and spend more when they eat out. After a household has a member 40 years or older,

participation and FAFH expenditure tend to start waning until having a senior member actually lowers participation and expenditures.

Elasticities are also calculated to indicate how much a percentage change in household composition affects participation and FAFH expenditure (Table 3.4 and Figure 3.1). The group 15-29 has the largest elasticities for both participation and expenditure. A 1% increase in the number of members of this age in a household will increase participation by .06% and total expenditure by .17%. The next oldest age group, 30-39, has the second largest elasticities, and these elasticities are also positive and significant. The opposite is the case for a 1% increase in the number of seniors. The elasticities are negative on both participation (-.03) and total expenditure (-.11).

Table 3.4. Elasticities with respect to selected exogenous variables

Variable	Participation	Conditional Expenditure	Total Expenditure
# of HH members 0<=age<=14	0.002	0.033	0.034
# of HH members 15<=age<=29	0.063	0.112	0.175
# of HH members 30<=age<=39	0.043	0.106	0.148
# of HH members 40<=age<=49	0.029	0.057	0.087
# of HH members 50<=age<=64	-0.008	-0.001	-0.009
# of HH members age>=65	-0.031	-0.084	-0.115
HH weekly disposable income (excluding wife's wages)	0.122	0.562	0.683
Wife's employment status (1=yes)	0.053	0.262	0.315
Wife's education(1=above high school)	0.054	0.181	0.236

Note: Elasticity is for discrete change of dummy variable from 0 to 1, and calculated at mean level of continuous variables.

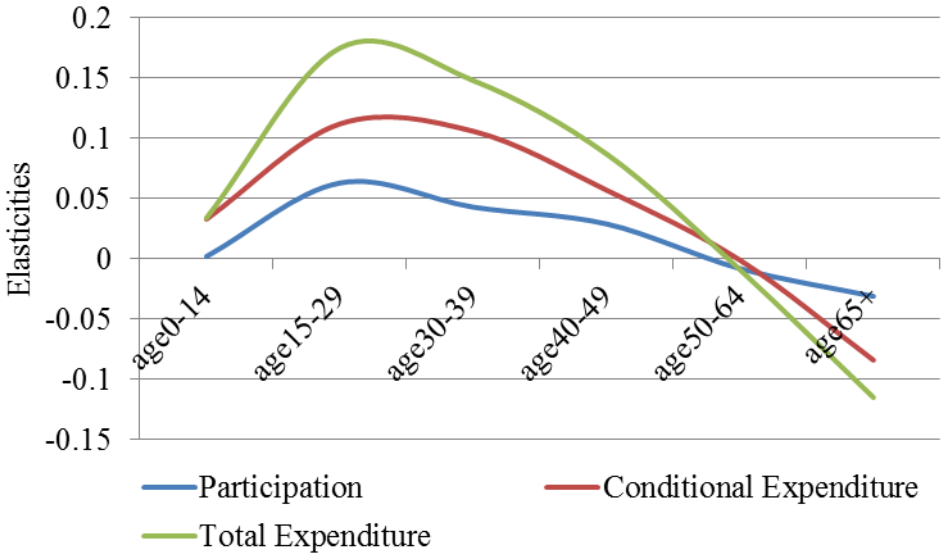

Figure 3.1. Elasticities with respect to household composition
Source: Calculated by Author, 2013

In addition to household composition, a number of other variables significantly affect FAFH participation and expenditure. The estimates for household income are significantly positive for both equations while the parameters of quadratic income are both significantly negative. This indicates that households are more likely to eat out and tend to spend more as income increases, but at a decreasing rate. The expenditure elasticities indicate that a 1% increase in household income will increase participation by .11% and FAFH expenditure by .68%. These results are consistent with the findings by Yen (1993), Gould and Villarreal (2006), and Bai, et al. (2010). Whether the household wife works in the labor market, an indicator of the opportunity cost of time, has an insignificant effect on participation, likely due to the relatively high participation rate in our sample, but it does significantly and positively affect FAFH expenditure. Wife's education affects both FAFH participation and expenditure positively. Also, as

expected, FAFH expenditure increases significantly with the number of non-family members present and with the number of times of dining out on weekends. City effects are found to be statistically significant for the expenditure equation but not the participation equation. Beijing is represented by the overall constant terms, and the city-effect coefficients are negative and significantly different from zero except in the case of Chengdu. This indicates that households in the other four cities spend less when dining out than households in Chengdu and Beijing. The elasticities of these variables are calculated and reported in Table 3.4.

3.5. Discussion

China now has more people living in urban areas than in rural ones. By 2050, it is projected that 78% of China's population will be urban (UN, 2011). While China's total population is projected to peak around 2030, urban population continues to grow through 2050. The composition of China's population is also projected to change. Currently, the age groups 15-29 and 0-14 years are the two largest age groups accounting for 43% of the total urban population (Figure 3.2), but by 2050 these two age groups will constitute only 27%. The senior group (65 years old and above) is now the smallest age group (9%), but it will be the largest group (31%) in 2050 (Figure 3.2). The trajectories of the changes in urban population within the six age groups are presented in Figure 3.3. The overall population in all groups younger than 50 years is decreasing over the projection years, while that in groups 50-64 and 65 years and above are growing rapidly during years 2010-2050.

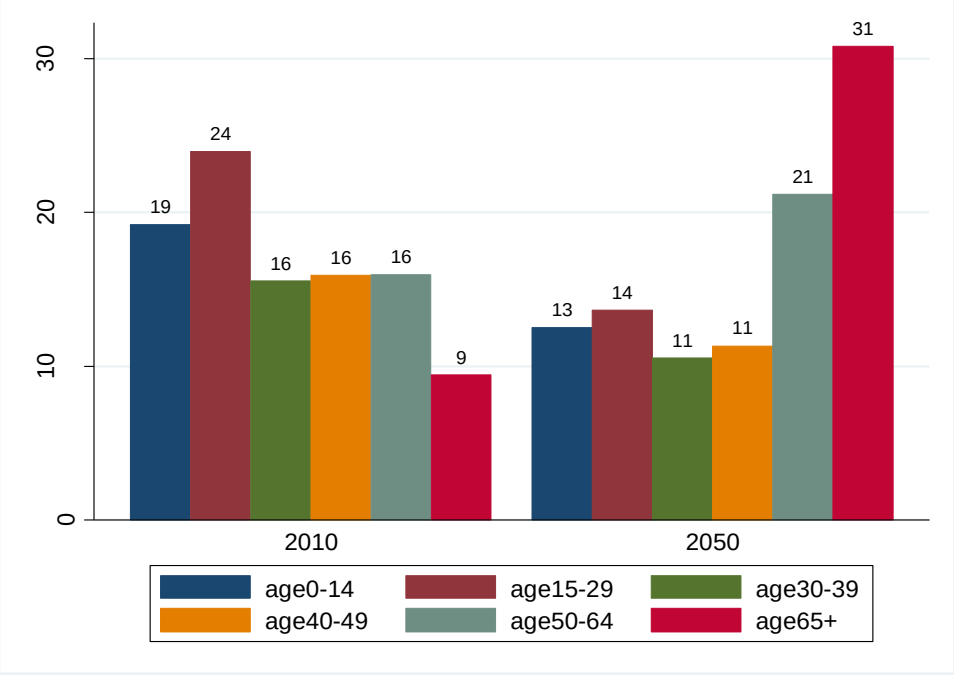

Figure 3.2. Population by age groups in urban China 2010 and 2050
Source: United Nations, World Population Prospects: the 2010 Revision.

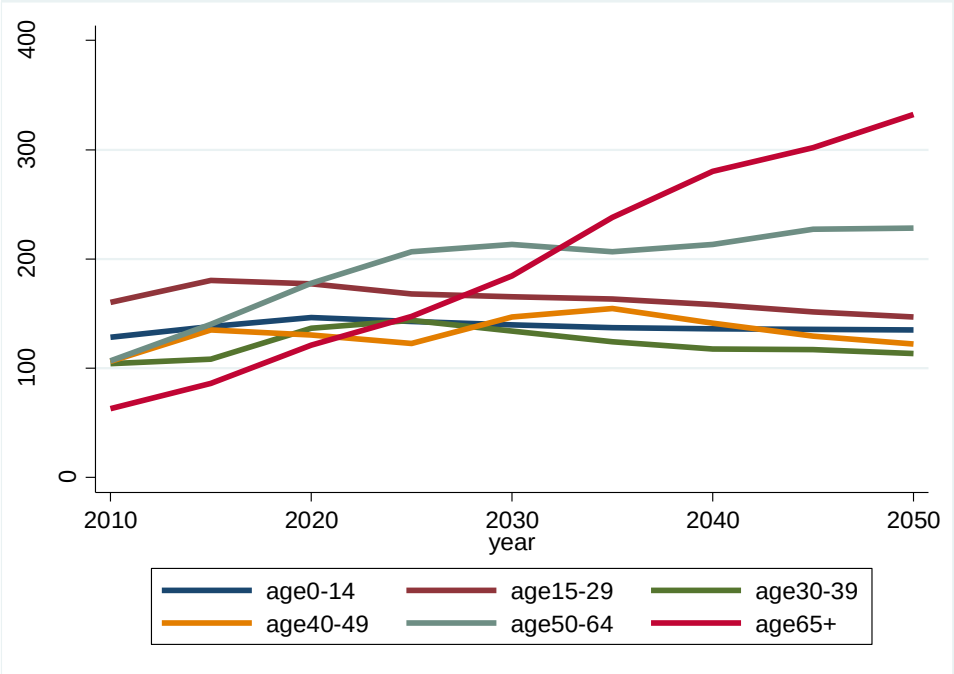

Figure 3.3. Population projections by age group in urban China
Source: United Nations, World Population Prospects: the 2010 Revision.

As demonstrated in the empirical section, household composition and income significantly affect demand for FAFH. With continued income growth in China and the large difference in future population demographics, demand for FAFH should change significantly. Accordingly, future projections of FAFH consumption should be important for public policy makers, private industry, and consumers.

Using the income and household composition elasticities (Table 3.4) and the UN urban population projections, the growth in FAFH consumption is forecast over the next four decades. The year 2010 is the baseline year, and FAFH expenditures in the six age groups are normalized to one. Growth of per capita disposable income starts at 9% in 2010 and is assumed to decrease by 0.5% every five years falling to 5.5% in 2050 to reflect China's continued development. For the demographic effects, FAFH consumption patterns are allowed to change as people grow older and join the next age group. Forecast results are presented in Figure 3.4.

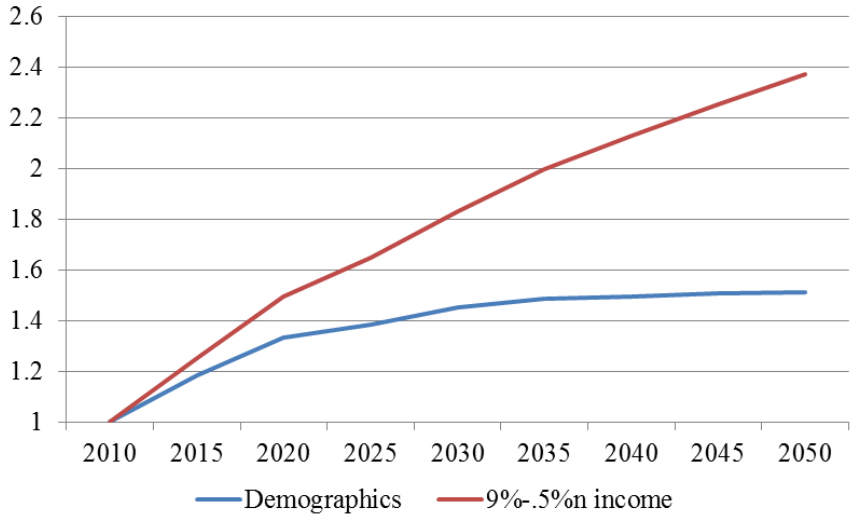

Figure 3.4. Forecasts of demographic and income effects on FAFH expenditure
Source: Calculated by Author, 2013

While income has a larger growth effect on future urban FAFH consumption, household composition is definitely a determining factor. On the whole, total FAFH expenditure in urban China will increase over the next 40 years at a decreasing rate. First, between 2010 and 2020, it increases rapidly influenced by growth due to the demographic and income effects. As urban population and income continue to increase accompanied by an increasing percentage of seniors in the population, total FAFH expenditure continues to grow but much more slowly.

The projection suggests how urban China's FAFH expenditure will change over the next four decades from an increasing population accompanied by significant aging and increasing but slower income growth. However, there are limitations to the projections. Firstly, our survey samples are only from China's top- and second-tier cities while our projections are based upon total urban population which may amplify the effects of the oldest age group. Secondly, changes in other variables' such as wife's education and labor participation that are shown to have significant effects on FAFH expenditure are not considered in the projections. Thirdly, the assumption on income growth rate might not be accurate.

3.6. Conclusions

Household age structure in China is found to have significant effects on urban FAFH consumption. People between the ages of 15 to 39 years dine out more often and spend more when doing so while people older than 40 years are less likely to eat away from home, especially those 65 years old and above. China's urban population is projected to grow over the next four decades reaching 78% of the population by 2050.

The structure of the population will also dramatically change, with a large increase in seniors. While the increased number of seniors will positively affect FAFH expenditure in urban China, the propensity for this age group to dine out less and spend less when dining out will negatively affect demand. However, projections based on this study's household composition and income elasticities combined with UN population projections indicate that the overall effect on urban FAFH expenditure will be positive, and it will increase at a decreasing rate over the next 40 years.

Increases in urban FAFH expenditure have important implications for China's food industry as well as its infrastructure. How China meets large increases in FAFH expenditure will influence the urbanization process and its agriculture. Increasing urbanization accompanied by income growth will put massive stress on China's transportation infrastructure and food distribution system. As FAFH establishments generally provide high quality food in appearance and nutrition, China will have to modernize its production base and its method of food distribution. All these factors may lead to changes in land tenure, wage structure, and general living standards for rural and urban populace.

Continued growth in urbanization and the accompanying FAFH expenditure will also potentially increase China's demand for imported foods to meet the needs of this market. This potentially will strengthen China's international relationships and allow it to allocate its scarce resources to producing the foods in which it has comparative advantage. It will be most interesting as China faces the dynamics of demographic changes and their effects on food consumption, particularly FAFH.

4. THE INFLUENCE OF FOOD DINING LOCATION ON ADULT OVERWEIGHT AND OBESITY IN URBAN CHINA

4.1. Introduction

Overweight and obesity are increasingly one of the most serious public health challenges of the 21st century. Globally, the age-standardized prevalence of being overweight increased from 24.6% in 1980 to 34.4% in 2008, and the prevalence of obesity increased from 6.4% to 12.0% during this period(Stevens, et al., 2012).More than 1.4 billion adults, 20 and older, were overweight in 2008, with over 200 million men and nearly 300 million women being obese. If current trends are unabated, the world's overweight and obese population could rise to a total of 2.16 billion and 1.12 billion, or 38% and 20% of the world's adult population by 2030, respectively(Kelly, et al., 2008). Particularly, 43 million preschool children (under the age of five) were overweight or obese in 2010, and 35 million of these live in developing countries. If this trend continues, this number is expected to reach 60 million in 2020, which equals to 12.7% of the global population(De Onis, et al., 2010).

Overweight and obesity have also become serious problems in China which used to be one of the leanest populations worldwide. According to the World Health Organization's Global Info Database (Ono T, et al., 2005), for those ages 15 and older, 45 percent of males in China and 32 percent of females were overweight. On average, 38.5 percent of the 2010 population has a BMI greater than or equal to 25. This is a sharp increase from the 2002 statistic of 25.1 percent and is estimated to continue increasing to 48.4 percent in 2015. Moreover, the overall obesity prevalence in 2015 is estimated to be twofold the rate in 2010.

The causes of obesity are multifactorial (Agurs-Collins and Bouchard, 2008). Three causes for the rise of obesity were identified by Oliver and Lee (2005) – genetic factors (i.e. inherited from parents), environmental factors (i.e. poor food in restaurants, diets ineffective), and personal factors (i.e. lack willpower, obese don't care). But their study shows that most Americans still believe obesity is the individual failure to eat less and exercise more. A nationwide survey conducted by Lusk and Ellison (2013) reveals that Americans perceive individuals are primarily to blame for the rise of obesity, while parents are the next-most blameworthy group. Similar findings are also stated by (Tomer, 2013, Wang and Coups, 2010). A number of specific demographic and socioeconomic factors have been shown to be relevant to obesity as well, including marital status (Averett, et al., 2008), education (Cai, et al., 2013, Sadiq and Martin, 2006), household income (Jolliffe, 2011, Ljungvall and Gerdtham, 2010), employment status (Mosca, 2013), smoking status (Liu, et al., 2010), and physical activity (Zick, et al., 2009).

In addition to socioeconomic and demographic factors, the food service sector and food eating locations have been shown to have an important influence on nutrient intake and obesity. O'Dwyer, et al. (2005) examine the nutrient intakes of Irish adults between 1997 and 1999 at home, at work and outside the home, and further compare the diet quality outside by grouping this location as pub, deli and takeaways. They find intakes of energy, protein, fat and carbohydrate were significantly greater at home than at work or out. When people eat outside, alcohol contributed the greatest to total energy intake in pubs and fat had the largest contribution to total and food energy in takeaways. Fraser and Edwards (2010) find that in Leeds England, the density of fast food outlets has a significant positive correlation with the likelihood that a child

being overweight or obese, while the distance between a child's home and the nearest fast food restaurant does not significantly correlate with his/her weight status. However, Dunn, et al. (2012) show that the distance to the nearest fast-food restaurant and the number of fast-food restaurants within 1 mile and 3 miles of a participant's residence is positively correlated with both the frequency of consuming fast food meals and obesity risk for non-white rural residents in central Texas, although no significant relationship was found for whites. To address the endogeneity problem of fast-food availability, the distance between residence and the nearest major roadway connecting major metropolitan areas is used as an instrument, which was employed by Dunn (2009), (2010) and Anderson and Matsa (2011) previously. Besides, a European study indicates that eating at restaurants and similar establishments which include cafeterias, bars or fast food outlets was positively associated by BMI and weight change (Naska, et al., 2011). Overall, the bulk of existing research has documented that poor diet quality or high body mass indices (BMI) are associated with greater consumption of food away from home (FAFH) among Americans (Bezerra and Sichieri, 2009, Binkley, et al., 2000, Binkley, 2008, Bowman and Vinyard, 2004, Bowman, et al., 2004, Clemens, et al., 1999, Guthrie, et al., 2002, Mancino, et al., 2009, Paeratakul, et al., 2003).

However, little attention has been paid to how food eating location affects adults' weight changes in China, although there are reports saying fast food expansion leads to the rise of obesity (Barnard, 2012, Bruno, 2013, Patterson, 2011). It is reported that not only eating at fast food outlets can cause obesity, but eating at other types of restaurants may also increase obesity. Therefore, given the severity of obesity in China, the well-known harmful consequences to health, and the paucity of rigorous research on this topic, this paper analyzes adult overweight

and obesity in urban China focusing on the effects of food eating locations when people dine away from home. Data used in the analysis were collected by the authors in recent surveys in urban China. Ordinary Least Squares and Ordered Probit models are fit to the data, coefficients are estimated, and the marginal effects are also calculated.

The structure of the paper is as follows. The methodology of the paper is briefly discussed and followed by a descriptive analysis of the data. Empirical results are presented in the next section. Finally, we discuss our major findings and the potential implications.

4.2. Methodology

Evidence has been found from longitudinal and cross-sectional studies that the WHO BMI cut-points to define overweight and obese ($BMI \geq 25$ and $BMI \geq 30$), which were developed from studies on mortality on Europids (World Health Organization, 2000), underestimate the risk in Chinese and other Asian populations (Deurenberg-Yap, et al., 1999, Ko, et al., 1999, Pan, et al., 2004, Zhou, 2002, Zhou, 2002). The Working Group on Obesity in China has recommended that a BMI of 18.5 to less than 24.0 should be considered as optimal, 24.0 to less than 28.0 as overweight, and 28.0 and above as obese (Zhou, 2002, Zhou, 2002). Thus, the analysis in this paper is based on the Chinese criteria, while that on the WHO criteria is also provided.

Econometrically, OLS, binomial and multinomial models have been frequently used in obesity research. Dunn (2010) used OLS to analyze the effect of fast food availability on obesity by geographic location, gender, and race/ethnicity. Contining in 2012, their research objectives are narrowed to only rural residents in central Texas instead of the entire United States, and probit and ordered logit regressions are employed (Dunn, et al., 2012). Multinomial logit and

quantile regressions are utilized to examine the relationship between income and BMI (Garc á Villar and Quintana-Domeque, 2009, Jolliffe, 2011, Schmeiser, 2010). BMI in the current paper has a basic normal distribution (Figure 4.1); therefore, an OLS model is used to analyze the effect of food eating location on obesity where continuous BMI is the dependent variable. Further, an ordered probit model is used to examine the relationship by categorizing body weight as underweight, normal, overweight and obese according to Chinese criteria and WHO criteria respectively. The categorical dependent variable takes on value of 0 if the individual is underweight, 1 if normal weight, 2 if overweight and 3 if obese.

BMI increases for both men and women during marriage and in the course of a cohabiting relationship (Averett, et al., 2008). And the study of Sobal, et al. (2003) shows that marital change is predictive of the variation in weight changes in the US National Health and Nutrition Epidemiological Follow-up Survey (NHEFS).

The presence of children in a household affects adults' diet behaviors. Laroche, et al. (2007) indicate that American adults in households with children tend to consume higher amount of total fat and saturated fat. Both men and women gained weight compared with those without children from a study on young Australian adults (Burke, et al., 2004).

Increasing education has been found to be negatively related to BMI. Sadiq and Martin (2006) find that young women between 18 and 34 years of age in Scania with low education are more likely to be overweight or obese, while students have a significantly higher odds to become underweight. Research based on the World Health Organization (WHO) MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) Project suggests an inverse relationship between education level and BMI. Lower education was associated with higher BMI in about

half of the male and in almost all of the female populations (Molarius, et al., 2000). Besides, Hjartaker, et al. (2001) indicates that the more education a Norwegian woman between 45-69 years has, the more likely that she attempts to lose weight. And Wardle, et al. (2002) show that obesity risk is greater among both men and women with fewer years of education in England. The negative relationship was also found in a Chinese study (Cai, et al., 2013).

Income is related to many health outcomes. Based on distribution-sensitive measures of being overweight, Jolliffe (2011) finds the severity of being overweight has been higher for the poor than the non-poor from 1971 to 2006 for Americans. His results imply that increases in income are correlated with healthier BMI values for underweight and obese individuals. In both OLS and IV bootstrapped models, the probability of being obese decreases with mean income (Ljungvall and Gerdtham, 2010). After decomposing household income into "own labor earnings" and "other household income", Garc á Villar and Quintana-Domeque (2009) find that the negative association between household income and body mass index for European women appears to be driven by the negative relationship between BMI and "own labor earnings" for women. However, in a study on rural southwestern Chinese, yearly household income is found to be positively associated with the prevalence of central obesity, which is defined as a waist circumference (WC) >90 cm in men and >80 cm in women (Cai, et al., 2013).

Sadiq and Martin (2006) show that young women in Scania who over worked have a higher chance to be underweight, while those unemployed are more likely to be overweight or obese. Data from old Irish adults indicates that employment status and obesity are negatively related, and the association is larger for women Mosca (2013).

Smoking cigarettes is associated with slightly lower body weights (Klesges, et al., 1989). Liu, et al. (2010) find a significant negative correlation between BMI/obesity and smoking status among American adults over 18 years old. Using data from a British Household Panel Survey in 2004 and 2006, Pieroni and Salmasi (2012) reveal the positive effect of quitting smoking on weight changes, which is also found to increase in the highest quantiles.

Physical activity is well-known to help people maintain a healthy body mass. Zick, et al. (2009) study the relationship between neighborhood features that facilitates physical activity and obesity risk using a sample from Salt Lake County, Utah, U.S. They find neighborhoods where a higher fraction of the population walks to work have a lower BMI/obesity risk. And for individuals living in non-low income neighborhoods, the presence of one or more convenience stores, full-service restaurants, or fast food restaurants is associated with reduced BMI/obesity risk, compared to having no neighborhood food outlets.

Whether the family has members with dietary problems is also included in the model. People with hypertension, hyperglycemia, hyperlipidemia and other health issues usually have special diets compared with their counterparts; therefore, it may affect the BMI of themselves and even other household members. Finally, regional dummies are included to control for regional differences. The surveys in all three cities were done in 2011 and almost at the same time; therefore, year dummy is not included.

4.3. Data

The household data used in this study are collected by surveying 571 households in three Chinese cities (Xi'an, Shenyang and Xiamen) in 2011. The number of households is 215 for Xi'an, 207 for Shenyang, and 149 for Xiamen. All three cities are sub-provincial cities of their

province, and the populations are 3.61 million for Xiamen, 8.18 million for Shenyang and 8.43 million for Xi'an in 2011 (SHENYANG GOVERNMENT, 2013, THE PEOPLE'S GOVERNMENT OF SHAANXI PROVINCE, 2012, 2012). The current paper focuses on food consumption and health conditions of adults in urban China; therefore, those younger than 18 years old are dropped resulting in 1,381 Chinese adults used in the analysis.

The households in our survey are selected by a stratified and random sampling approach from households participating in the Urban Household Income and Expenditure (UHIE) survey in each city. The UHIE survey is the primary official information on urban consumers' income and expenditures and is a primary data source of the published China Statistical Yearbooks. In our survey, selected households record each food item that is consumed by each household member, both at home and away from home, for seven consecutive days. A drop-off and pick-up approach is applied. Detailed information on demographics and socio-economics of the household are also collected in the survey. See Bai, et al. (2012) and Bai, et al. (2010) for detailed information of the survey.

The body mass indexes of our sample individuals are normally distributed in Xi'an, Shenyang and Xiamen (Figure A.1.). Table 4.1 describes the BMI distribution in each city separately for men and women aged 18 to 91 in 2011. The overall average BMI for men (23.38) is higher than that for women (22.29), but with a smaller variation. Each city displays the similar pattern, but BMI for males in Xi'an has a larger variance than for females. For both men and women, Xiamen has a lowest mean BMI, particularly for women. On the other hand, Shenyang has a highest BMI for both cohorts, and this holds for almost all the BMI percentiles. The

median BMI for men (women) ranges from 23.03 (21.33) to 23.51 (22.50) (Table 4.1 column p50), both at healthy levels.

Table 4.1. BMI distribution in 2011 by gender, age 18-91

		Mean	SD	Percentiles					N
				p10	p25	p50	p75	p90	
Men	Xian	23.50	3.03	19.37	21.78	23.51	25.35	27.55	262
	Shenyang	23.60	2.82	20.06	21.80	23.43	25.80	27.34	236
	Xiamen	22.93	2.84	19.37	20.98	23.03	24.47	26.61	181
	Average	23.38	2.92	19.71	21.62	23.18	25.35	27.10	679
Women	Xian	22.23	2.59	18.82	20.40	22.22	23.88	25.30	269
	Shenyang	22.91	3.68	19.28	20.83	22.50	24.47	26.67	250
	Xiamen	21.54	3.12	17.72	19.05	21.33	23.42	25.48	183
	Average	22.29	3.19	18.59	20.20	22.04	24.04	25.82	702

Table 4.2 shows the body weight categories and the prevalence of obesity. In total, seven percent of our sample individuals are underweight (BMI<18.5). Shenyang has the lowest percentage of people being underweight (5%); in contrast, 12% of the citizens in Xiamen are underweight. Xi'an is in the middle, with 6% people over skinny. According to the Chinese criteria, 60 percent of the sample adults in Xi'an, Shenyang and Xiamen are healthy in terms of BMI, which range from 18.5 to 24.0. Surprisingly, there have been more than 30 percent of the people overweight, of which 5% are even obese. Comparatively, Xiamen has the largest number of people with BMI in normal ranges, and Shenyang is at the opposite, Xi'an in between. Less than 60 percent of the individuals in Shenyang have a normal BMI, more than 30 percent of its

population have a BMI between 24.0 and 28.0, and 6% are obese with BMI of 28.0 and above. Xiamen has 62% people within normal weight ranges, 22% overweight and the percentage obese is the lowest as 4%.

Table 4.2. Body weight categories and the prevalence of obesity (Percent)

	Chinese criteria				WHO criteria			
	Average	Xian	Shenyang	Xiamen	Average	Xian	Shenyang	Xiamen
Underweight	7	6	5	12	7	6	5	12
Normal	60	62	57	62	72	74	71	71
Overweight	28	27	33	22	19	18	22	15
Obese	5	5	6	4	2	2	2	1

Applying the WHO criteria, we get similar results, but obesity becomes less serious. Although Shenyang still has the highest proportion of people overweight or obese, and Xiamen is to the opposite, the difference shrinks. Interestingly, all three cities have nearly the same percent of people with BMI falling in the normal range. Moreover, Xi'an is better than Xiamen under this scenario, because it becomes the one with the largest population having healthy weight.

Table 4.3 displays the participation of Food-Away-From-Home (FAFH) consumption and the food eating location frequencies. Overall, 66 percent of the sample adults 18 years and above participated in FAFH consumption. Dining away from home is most prevalent in Xi'an where 72 percent of the adults had FAFH consumption experiences, but the least popular in Xiamen which only has 59 percent of the adult population dining out for at least once during our

survey week. Shenyang is at the average level, with 66 percent of the adults taking part in FAFH consumption.

Table 4.3. Food dining locations by city (Percent)

	Individuals consuming FAFH	Food Dining Locations			
		Restaurant	Fastfood	Cafeteria	Other
Xian	72	21	18	31	30
Shenyang	66	23	23	48	6
Xiamen	59	12	32	45	11
Average	66	20	23	39	18

Note: restaurant means full service restaurants, fastfood means fast food outlets.

Generally, a cafeteria is the most common place that people go if they choose to dine out. Nearly 40 percent of the meals were consumed at cafeterias in Xi'an, Shenyang and Xiamen in total. Fast food restaurants have been more and more popular in urban China these years, and they took 23 percent of the FAFH consumption experiences. Visits to table-service restaurants and other eating places are almost equal, with restaurants two percent higher.

Looking at each individual city, we can find that adults all eat at cafeterias most often, particularly Shenyang where almost one half the meals consumed away from home happened at cafeterias. Xiamen and Xi'an have 45 percent and 30 percent of the FAFH meals taking place at cafeterias respectively. Except the most frequently visited eating place, there are significant regional differences about the other eating locations. Adults in Xi'an prefer to places other than table-service restaurants, fast food restaurants or cafeteria; 30 percent of the FAFH meals were consumed at this venue. While for people in Shenyang and Xiamen, fast food restaurants are

their second frequent choice, more often for Xiamen where one third of the meals were taken at fast food outlets. Besides, the visits to table service restaurants and fast food restaurants are almost equal in both Xi'an and Shenyang, but not for Xiamen. In addition, a substantial amount of the FAFH meals occurred at either table service restaurants, or fast food restaurants, or cafeteria for Shenyang, but for Xi'an and Xiamen, there are still a fairly large portion of the meals at other places.

Food eating locations by meal and city are shown in Table 4.4. On the whole, the most popular place to have breakfast away from home is neither restaurants nor cafeterias, but other places such as roadside stands. A cafeteria is the second often place for breakfast if adults in Xi'an, Shenyang and Xiamen decide to have it away from home. For lunch, a cafeteria is the busiest place in total, with nearly one half of the lunches away from home. Following cafeterias, more than one fifth of the lunches were taken at fast food outlets. For dinner, 37 percent was consumed at full service restaurants, while another 30 percent were consumed at cafeterias.

In each of the three cities, although all the people have lunch most often at cafeterias, there are significant differences in terms of breakfast and dinner. Roadside stands are the major providers of FAFH breakfast for residents in Xi'an; about half of the time people buy and consume breakfast from these places. But cafeterias and fast food restaurants are the first choices for adult individuals in Shenyang and Xiamen respectively. For dinner, adults in Xi'an and Shenyang usually choose full service restaurants if they eat away from home, but cafeterias and fast food restaurants are the top two choices for the population in Xiamen.

Table 4.4. Food eating locations by meal and city (Percent)

	Average			Xi'an			Shenyang			Xiamen		
	B	L	D	B	L	D	B	L	D	B	L	D
restaurant	12	17	37	11	24	33	18	17	57	10	9	24
fastfood	25	23	19	18	20	16	35	22	14	39	31	32
cafeteria	27	48	30	23	37	31	36	55	26	35	52	33
other	36	11	13	48	20	20	10	6	4	16	9	11

Note: For the convenience of display, B, L and D are abbreviations for breakfast, lunch and dinner respectively.

The summary statistics of variables used in regressions are reported in Table 4.5. During our entire survey week, the average times of meals consumed at full service restaurants, fast food outlets, and cafeterias are 0.82, 0.96 and 1.63 times respectively. If we only consider the consuming FAFH sample, then the average times are 1.23, 1.45, and 2.46 respectively (Table A.3.), which is consistent with the results in Table 4.3.

Table 4.5. Summary statistics of variables used in regressions

Variable	Description	Obs	Mean	SD	Min	Max
bmi	Kg/m^2	1381	22.83	3.11	13.54	55
categoryc	Chinese criteria	1381	1.31	0.68	0	3
categoryw	WHO criteria	1381	1.15	0.55	0	3
restaurant	# meals at full service restaurant/week	1381	0.82	1.59	0	14
fastfd	# meals at fast food outlet/week	1381	0.96	2.02	0	16
cafeteria	# meals at cafeteria/week	1381	1.63	3.26	0	21
gender	1=male	1381	0.49	0.50	0	1

(continued)

Table 4.5. Summary statistics of variables used in regressions (continued)

Variable	Description	Obs	Mean	SD	Min	Max
age	Years	1381	46.93	15.12	18	91
couple	1=married	1381	0.81	0.39	0	1
nchild	# of children<18 in HH (persons)	1381	0.41	0.53	0	2
College	1=college+	1381	0.47	0.50	0	1
pcawkinc	per capita weekly HHincome (1000 yuan)	1381	0.48	0.30	0.04	3.69
Employ	employment status					
	full-time (1=yes)	1381	0.56	0.50	0	1
	part-time (1=yes)	1381	0.01	0.08	0	1
	retired (1=yes)	1381	0.28	0.45	0	1
	homeworker (1=yes)	1381	0.05	0.21	0	1
	unemployed (1=yes)	1381	0.05	0.23	0	1
	student (1=yes)	1381	0.04	0.20	0	1
Smoke	smoking status					
	currently smoking (1=yes)	1381	0.23	0.42	0	1
	never (1=yes)	1381	0.72	0.45	0	1
Prac	times/month	1381	9.75	12.64	0	60
Disease	1=HH has member with dietary problems	1381	0.67	0.47	0	1
Xian	1=yes	1381	0.38	0.49	0	1
Shenyang	1=yes	1381	0.35	0.48	0	1
Xiamen	1=yes	1381	0.26	0.44	0	1

Other socioeconomic variables for the whole sample are also reported in Table 4.5. 49 percent of our sample individuals are men, the mean age is 47 years ranging from 18 to 91. 81 percent of the adults are married, and 47 percent of them received education at college level and above. The sample households have children no more than two, and the average number of children younger than 18 in a household is 0.41. Per capita weekly disposable income is 480 Yuan on average. Fifty-seven percent of the individuals 18 years above worked in the labor market, either having a full-time job or part-time job, but more people were full-time employees in Xi'an than Shenyang and Xiamen (Table A.1.). Seventy-two percent of our sample individuals never smoke, but there are still 23 percent currently smoking (Table A.2.). On average, people in these three cities exercise 10 times in a month. In addition, 67 percent of the individuals live in a household that has at least one member having dietary problems such as hypertension, hyperglycemia and hyperlipidemia.

4.4. Empirical Results

Regression estimates of the relationship between body weight and food eating locations are reported in Table 4.6. Results from the Ordinary Least Squares regression do not show any significance of food eating locations to BMI (Table 4.6 column (1)). However, a non-linear relationship between BMI and food eating location may emerge.

To explore the non-linear relationship, an ordered probit model between the weight categories and food eating locations is estimated (Table 4.6 column (2) and (3)). Similar to the OLS results when regressing BMI on food eating locations, the ordered Probit results indicate that the number of meals eaten at cafeterias is significantly and positively correlated with body weight. The more meals consumed at a cafeteria, the more likely this person gains weight.

Table 4.6. OLS and Ordered Probit estimates between BMI/Body Weight Category and food eating locations[1]

	BMI	Chinese criteria	WHO criteria
	OLS	Ordered Probit	Ordered Probit
VARIABLES	(1)	(2)	(3)
restaurant	0.011	0.003	-0.004
	(0.053)	(0.020)	(0.022)
fastfd	-0.028	0.001	-0.017
	(0.042)	(0.016)	(0.017)
cafeteria	0.044	0.021*	0.023**
	(0.028)	(0.011)	(0.011)
gender	1.033***	0.350***	0.361***
	(0.204)	(0.079)	(0.084)
age	0.016*	0.007**	0.008**
	(0.009)	(0.003)	(0.004)
couple	0.744***	0.219**	0.226**
	(0.243)	(0.094)	(0.100)
nchild	-0.363**	-0.146**	-0.175**
	(0.168)	(0.065)	(0.069)
college	-0.653***	-0.204***	-0.088
	(0.177)	(0.068)	(0.073)

(continued)

[1] See methodology section for Chinese Criteria and WHO Criteria.

Table 4.6. OLS and Ordered Probit estimates between BMI/Body Weight Category and food eating locations (continued)

	BMI	Chinese criteria	WHO criteria
	OLS	Ordered Probit	Ordered Probit
VARIABLES	(1)	(2)	(3)
pcawkinc	0.516*	0.113	0.116
	(0.288)	(0.110)	(0.119)
Employment			
full-time	2.084*	0.759*	1.011**
	(1.134)	(0.442)	(0.467)
part-time	2.100	1.401**	1.463**
	(1.475)	(0.565)	(0.603)
retired	1.939*	0.680	0.922*
	(1.148)	(0.447)	(0.473)
homeworker	2.422**	1.009**	1.288***
	(1.189)	(0.463)	(0.490)
unemployed	1.956*	0.680	1.001**
	(1.175)	(0.457)	(0.483)
student	1.399	0.580	0.792
	(1.223)	(0.477)	(0.504)
Smoke			
currently smoking	-1.032***	-0.512***	-0.369**

(continued)

Table 4.6. OLS and Ordered Probit estimates between BMI/Body Weight Category and food eating locations (continued)

	BMI	Chinese criteria	WHO criteria
	OLS	Ordered Probit	Ordered Probit
VARIABLES	(1)	(2)	(3)
	(0.399)	(0.150)	(0.158)
never smoke	-0.912**	-0.415***	-0.327**
	(0.395)	(0.148)	(0.156)
prac	-0.010	-0.004	-0.008***
	(0.007)	(0.003)	(0.003)
disease	0.435**	0.134**	0.130*
	(0.174)	(0.067)	(0.072)
Shenyang	0.340*	0.138*	0.134*
	(0.190)	(0.073)	(0.078)
Xiamen	-0.755***	-0.317***	-0.285***
	(0.214)	(0.083)	(0.088)
Constant	19.873***		
	(1.263)		
Observations	1,381	1381	1381
(Pseudo) R^2	0.106	0.047	0.052
BIC		2811.314	2291.490

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

However, the probability of getting obese is not significantly related to the number of meals consumed at restaurants which can be seen from the insignificant coefficients on full service restaurant and fast food outlet. Though both are insignificant, the signs of the coefficients are different when using different criteria. When applying the Chinese criteria of classification, the more meals eaten at restaurants, the higher probability that he/she gains weight, but a negative relationship is shown when using the WHO classification.

Since the coefficients from the ordered probit model themselves are not very meaningful, the marginal effects are calculated and reported in Table 4.7 with P-values presented below the coefficients. Despite the significance in all groups, the marginal effects of eating at cafeterias on body weight are different across the weight categories. If the number of meals eaten at a cafeteria increases by one, the probability that a person in Xi'an, Shenyang and Xiamen is underweight decreases by 0.25 percentage point, and the probability for a person's weight being normal decreases by 0.49 percentage point. However, a one unit increase in the number of meals eaten at a cafeteria increases the probability to be overweight and obese by 0.55 and 0.19 percentage point respectively. Using the WHO classification, the marginal effects are comparable on the whole, but the magnitudes are slightly bigger for underweight group and smaller for normal and obese groups. Despite of the insignificance of the number of meals had at restaurants, these results are overall consistent with the findings of numerous studies which indicate that eating away from home contributes to overweight and obesity (Binkley, et al., 2000, Bowman, et al., 2004, Dunn, et al., 2012, Fraser and Edwards, 2010, Guthrie, et al., 2002, Mancino, et al., 2009, Naska, et al., 2011).

Table 4.7. Marginal effects of food eating locations on Body Weight Category

	Chinese criteria				WHO criteria			
	Underweight	Normal	Overweight	Obese	Underweight	Normal	Overweight	Obese
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
restaurant	-0.0003	-0.0006	0.0007	0.0002	0.0005	0.0006	-0.0010	-0.0001
	(0.8970)	(0.8970)	(0.8970)	(0.8970)	(0.8490)	(0.8490)	(0.8490)	(0.8490)
fastfd	-0.0001	-0.0002	0.0002	0.0001	0.0021	0.0027	-0.0042	-0.0006
	(0.9680)	(0.9680)	(0.9680)	(0.9680)	(0.3120)	(0.3170)	(0.3120)	(0.3220)
cafeteria	-0.0025	-0.0049	0.0055	0.0019	-0.0027	-0.0035	0.0055	0.0007
	(0.0560)	(0.0560)	(0.0550)	(0.0570)	(0.0490)	(0.0510)	(0.0480)	(0.0610)
gender*	-0.0417	-0.0824	0.0922	0.0319	-0.0429	-0.0558	0.0869	0.0119
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0010)
age	-0.0008	-0.0015	0.0017	0.0006	-0.0009	-0.0012	0.0018	0.0002
	(0.0500)	(0.0500)	(0.0490)	(0.0510)	(0.0340)	(0.0360)	(0.0330)	(0.0440)
couple*	-0.0290	-0.0461	0.0576	0.0175	-0.0299	-0.0279	0.0516	0.0062
	(0.0360)	(0.0080)	(0.0180)	(0.0100)	(0.0430)	(0.0050)	(0.0170)	(0.0190)

(continued)

Table 4.7. Marginal effects of food eating locations on Body Weight Category (continued)

	Chinese criteria				WHO criteria			
	Underweight	Normal	Overweight	Obese	Underweight	Normal	Overweight	Obese
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
nchild	0.0173	0.0345	-0.0387	-0.0131	0.0208	0.0271	-0.0423	-0.0056
	(0.0250)	(0.0260)	(0.0240)	(0.0270)	(0.0110)	(0.0130)	(0.0110)	(0.0210)
college*	0.0245	0.0477	-0.0540	-0.0182	0.0105	0.0135	-0.0212	-0.0028
	(0.0040)	(0.0030)	(0.0030)	(0.0040)	(0.2300)	(0.2260)	(0.2260)	(0.2340)
pcawkinc	-0.0134	-0.0267	0.0300	0.0101	-0.0138	-0.0180	0.0280	0.0037
	(0.3080)	(0.3080)	(0.3080)	(0.3080)	(0.3270)	(0.3270)	(0.3270)	(0.3320)
full-time*	-0.1000	-0.1589	0.1931	0.0658	-0.1388	-0.1204	0.2262	0.0331
	(0.1290)	(0.0390)	(0.0610)	(0.0930)	(0.0660)	(0.0020)	(0.0160)	(0.0780)
part-time*	-0.0594	-0.4474	0.1797	0.3271	-0.0596	-0.4708	0.3292	0.2013
	(0.0000)	(0.0020)	(0.0050)	(0.1240)	(0.0000)	(0.0190)	(0.0000)	(0.2500)
retired*	-0.0657	-0.1867	0.1723	0.0802	-0.0839	-0.2044	0.2380	0.0504
	(0.0670)	(0.1590)	(0.0870)	(0.2340)	(0.0160)	(0.1070)	(0.0480)	(0.2260)

(continued)

Table 4.7. Marginal effects of food eating locations on Body Weight Category (continued)

	Chinese criteria				WHO criteria			
	Underweight	Normal	Overweight	Obese	Underweight	Normal	Overweight	Obese
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
homeworker*	-0.0598	-0.3261	0.2022	0.1838	-0.0646	-0.3990	0.3203	0.1433
	(0.0000)	(0.0350)	(0.0000)	(0.1680)	(0.0000)	(0.0220)	(0.0000)	(0.2010)
unemployed*	-0.0504	-0.2117	0.1618	0.1003	-0.0602	-0.2928	0.2669	0.0861
	(0.0080)	(0.1870)	(0.0470)	(0.3080)	(0.0000)	(0.0990)	(0.0160)	(0.2800)
student*	-0.0454	-0.1777	0.1423	0.0808	-0.0534	-0.2191	0.2154	0.0571
	(0.0420)	(0.2850)	(0.1360)	(0.3900)	(0.0010)	(0.2260)	(0.1050)	(0.3790)
currently smoking*	0.0755	0.0920	-0.1307	-0.0368	0.0512	0.0408	-0.0824	-0.0096
	(0.0050)	(0.0000)	(0.0000)	(0.0000)	(0.0440)	(0.0000)	(0.0110)	(0.0110)
never smoke*	0.0432	0.1095	-0.1087	-0.0439	0.0349	0.0598	-0.0822	-0.0124
	(0.0020)	(0.0100)	(0.0040)	(0.0180)	(0.0220)	(0.0690)	(0.0430)	(0.0890)
monthly practice	0.0004	0.0009	-0.0010	-0.0003	0.0009	0.0012	-0.0019	-0.0003
	(0.1740)	(0.1740)	(0.1740)	(0.1740)	(0.0070)	(0.0080)	(0.0060)	(0.0120)

(continued)

Table 4.7. Marginal effects of food eating locations on Body Weight Category (continued)

	Chinese criteria				WHO criteria			
	Underweight	Normal	Overweight	Obese	Underweight	Normal	Overweight	Obese
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
disease*	-0.0165	-0.0306	0.0355	0.0116	-0.0159	-0.0189	0.0308	0.0040
	(0.0560)	(0.0390)	(0.0470)	(0.0410)	(0.0820)	(0.0570)	(0.0670)	(0.0720)

Note: (*) dP/dx is for discrete change of dummy variable from 0 to 1, and calculated at mean level of continuous variables. p-value is in parentheses.

In addition to food eating locations, a number of other variables significantly affect body weight changes. The estimate for gender is significantly positive (Table 4.6), but the marginal effects differ among the four weight groups (underweight, normal, overweight and obese). From Table 4.7, the results indicate that males are 4.2 (8.2) percentage points less likely to be underweight (normal) compared to females, also they are 9.2 and 3.2 percentage points more likely to fall in the overweight and obese groups respectively (Table 4.7 column (1) to (4)). This is consistent with the results by (Wang, et al., 2007), but conflicting with the global opinion that more women are obese than men (Kanter, 2011, Ogden Cl, 2006).

Age is significantly positively correlated with the probability of gaining weight. A one year increase in age leads to a 0.08 and 0.15 percentage point decrease for being underweight and normal respectively, but a 0.17 and 0.06 percentage point increase for becoming overweight and obese correspondingly. This positive relationship is consistent with different previous studies (Anderson, et al., 2003, Baum, 2007, Flegal Km, 2002, Ogden Cl, 2006, Wardle, et al., 2002). Same effects are found between marital status and obesity. Married couples are more likely to gain weight and even become overweight and obese. The number of children younger than 18 is significantly and negatively related with both continuous BMI and categorical BMI, however the marginal effects are not statistically significant.

Socioeconomic factors have significant effects on our sample individuals' weight changes. Per capita weekly household disposable income is positively related with the probability of being obese in the OLS models but not in the ordered Probit models (Table 4.6), which leads to the insignificant marginal effects (Table 4.7). Income has been found to correlate with healthier BMI in the United States and Europe (Garc á Villar and Quintana-Domeque, 2009, Jolliffe, 2011, Ljungvall and Gerdtham, 2010), but a direct relationship was also found for

Chinese (Cai, et al., 2013). Considering our analysis is based on samples from China, the positive correlation is acceptable and comparable. The effect of education on weight change is consistent with the existing literature. Compared with people with high school education and less, individuals that received a college education and above are less likely to be overweight or obese. Groups with college education and above are 2.4 and 4.8 percentage points more likely to be underweight and have normal weight respectively, while 5.4 and 1.8 less likely to have extra weight (Table 4.7). Employment status has significant effects on the probability of gaining weight but different from the results on Scandinavian (Sadiq and Martin, 2006) and Irish (Mosca, 2013). Compared with students and others, people having labor market jobs, retired, homeworkers and unemployed all have higher probability to become overweight and obese, though at different levels. This is reasonable however, because all of these groups tend to be sedentary and under more stress which results in weight gain easily.

Smoking status matters for obesity. Current smokers and never smokers are more often to be overweight and obese. Physical activity reduces the likelihood of being overweight or obese as expected, but the marginal effects are small and not significant. Finally, we find that individuals living in households with members having dietary problems are more likely to have a higher BMI compared with their counterparts. This is within expectations because households with such members usually have problematic diets and other unhealthy living behaviors that will cause BMI to rise gradually. The regional differences are also found. Consistent with our descriptive analysis, compared with Xi'an, people in Shenyang are more likely to be overweight and obese, while Xiamen is in contrast to it.

4.5. Conclusions

Food eating locations in urban China are found to have significant effects on adults' BMI. Meals eaten at restaurants and cafeterias positively contribute to the gain of people's body weight. However, the number of meals eaten at full service restaurants and fast food outlets have not displayed significant effects, only those at cafeterias show statistically significant effect. The more meals consumed at cafeterias, the less likely a person becomes underweight or stays normal, and the more likely that he/she gains extra weight to become overweight and even obese. The marginal effects of number of meals at cafeterias are significant for all of these four groups, but the magnitudes differ. It has the largest marginal effect on overweight group; having one more meal at cafeteria increases the probability of being overweight by 0.55 percentage point. The next largest effect is on the normal weight group, with a marginal effect of 0.49 percentage point. The marginal effects at the tail of the BMI distribution are the smallest comparatively. The probability of being underweight decreases by 0.25 percentage point and of being obese increases by 0.19 percentage point if one additional meal is consumed at cafeteria.

The insignificant effect of full service restaurants and fast food restaurants on the probability of being overweight could be due to many reasons. First, about forty percent of the meals in our sample were consumed at cafeterias, table service and fast food restaurants only took 20 and 23 percent, around half less than that at cafeterias. Therefore, their effects may be insignificant due to the not frequent enough consumption. Second, full service restaurants normally have balanced dishes and cooked in elegant and healthy ways, thus, they might contribute to a healthy BMI. However, Food-Away-From-Home consumption usually contains more calories and fat which are detrimental to a healthy body weight. Hence, the effect of full service restaurants on body weight change could be insignificant. Third, fast food restaurants are

blooming in urban China, but according to Mintel (2013), “much of the growth to date has continued to benefit from a perceived 'novelty factor' enjoyed by fast food as the segment expands into smaller cities in China. The consumers in first- and a few second-tier cities where fast food has now been available for quite some time are becoming more attuned to the health issues often associated with fast food and are actively choosing healthier options when dining out.” Therefore, with the loss of consumers, fast food restaurants naturally will not have a significant effect.

The average median BMI of the adults in Xi’an, Shenyang and Xiamen is 23.18 for men and 22.04 for women. Twenty-eight percent of the adults are overweight ($24.0 \leq BMI < 28.0$) and 5 percent are obese ($BMI \geq 28.0$). The major finding of this study is that only meals consumed at cafeterias significantly and positively affect the likelihood that Chinese urban adults become overweight and obese, while meals eaten at table service restaurants and fast food outlets have no significant effect. Perhaps this result is surprising and inconsistent with the common intuition that China currently has a large population that is obese and that fast food is a major cause. However, much of the consumption at fast food outlets in urban China is by children and young adults. Whereas, the average age of our sample is 47 years and only 15 percent of the population is less than 30 years. Combing these two factors together, it is easy to understand that fast food is not a significant cause of Chinese adults’ obesity. China is facing severe weight problems of its adult population; however, most of these people have a weight that is still within the overweight rather than obese range.

5. CONCLUDING REMARKS AND FUTURE RESEARCH DIRECTIONS

5.1. Conclusions

China has experienced dramatic socio-demographic changes in the last three decades. The proportion of people living in the urban areas of China has increased to 51.27% in 2011 from 19.39% in 1980 according to the National Bureau of Statistics of China (NBSC) (2012). Meanwhile, the process of societal aging is proceeding and has become noticeable. Currently, 12.3% of China's urban population is 65 years and above, and it is expected to increase to 33.9% by 2050 (NBSC, 2012, UN, 2011). Increasingly being overweight or obese is another striking phenomenon. According to the World Health Organization's Global Info Database (Ono T, et al., 2005), for those aged 15 years and older, 45 percent of males in China and 32 percent of females were overweight in 2010, and the overall obesity prevalence for this group is estimated to be twofold the rate of 2010 by 2015, or from 3.8% to 7.6%. During these three decades, the proportion of Food-Away-From-Home consumption also increased to more than seven times the level before 1990. In 2011, 21.5 percent of the urban food expenditure was on FAFH, which was less than 10 percent in 1995. Considering such dramatic socio-economic changes, this study has two objectives. First is to analyze food-away-from-home (FAFH) consumption in urban China with respect to household consumption, income, and other socio-economic variables. The second is to examine the influence of food dining locations on adult overweight and obesity in urban China. The data used in this study are from household surveys in six representative Chinese cities collected by the authors: Beijing; Nanjing; Chengdu; Xi'an; Shenyang; and Xiamen.

Findings from a Box-Cox Double-Hurdle model in the first study indicate that household composition has significant effects on FAFH participation and expenditure, and different age groups have different influences. Adults 65 years or older eat out less frequently and spend less

when they do. Households with member between 15 and 39 years old dine out most often and spend more when they do. Children younger than 14 years have no significant effect on FAFH participation but do have a small positive effect on expenditure. Income growth increases FAFH participation and expenditure but at a decreasing rate. Wife's education positively affects FAFH participation and expenditure while the wife's working only positively affects expenditure. The projections show FAFH expenditures will increase initially rapidly and then slowly over the next four decades to changing demographics in China and continued but slower income growth.

The second part of this study analyses BMI and overweight issues of adults 18 years and above in urban China with respect to food dining locations and other socio-economic and demographic variables. OLS is used to estimate the relationship between continuous BMI and food eating outlets, and an Ordered Probit model is fit to the categorical BMI. Findings indicate that the number of meals eaten at cafeterias significantly increase the probability of being overweight and obese while decreasing the probability of staying underweight and normal. The probability that a person in Xi'an, Shenyang and Xiamen is underweight and normal decreases by 0.25 and 0.49 percentage point respectively if consuming one additional meal at a cafeteria. And one unit increase in the number of meals eaten at a cafeteria increases the probability to become overweight or obese by 0.55 and 0.19 percentage point correspondingly. The number of meals consumed at full service restaurants and fast food outlets are found to be insignificant on the body weight of Chinese adults. Education, household income and employment status all have significant effects on body weight change, as well as smoking status and physical activity.

5.2. Future Research

While both empirical studies presented here are successful in achieving the goals defined in this thesis, a number of limitations are still present that should be addressed in future research.

There were no standard classification of age groups when analyzing the effects of age composition on food consumption patterns; therefore, our grouping methods may be not proper for studies using other databases. The projections for FAFH expenditure in urban China only consider the effect of household composition and income with subjective assumptions about the dynamic of dining preferences and income growth, the results could be different if we include other factors into our projection or change our assumptions. In addition, BMI may not be an accurate representation of being overweight or obese, however, we did not have other information that could give a better reflection. Future surveys may pay attention to this question.

Other limitations may be referred to the data. Although the six cities in the first empirical research are distributed throughout China, the sample is still not large enough to represent all of China. Especially, we did not have data for central or northeastern China. For the second study, only data from three cities were used, which certainly does not be represent all of China. Future studies should include more cities.

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APPENDIX

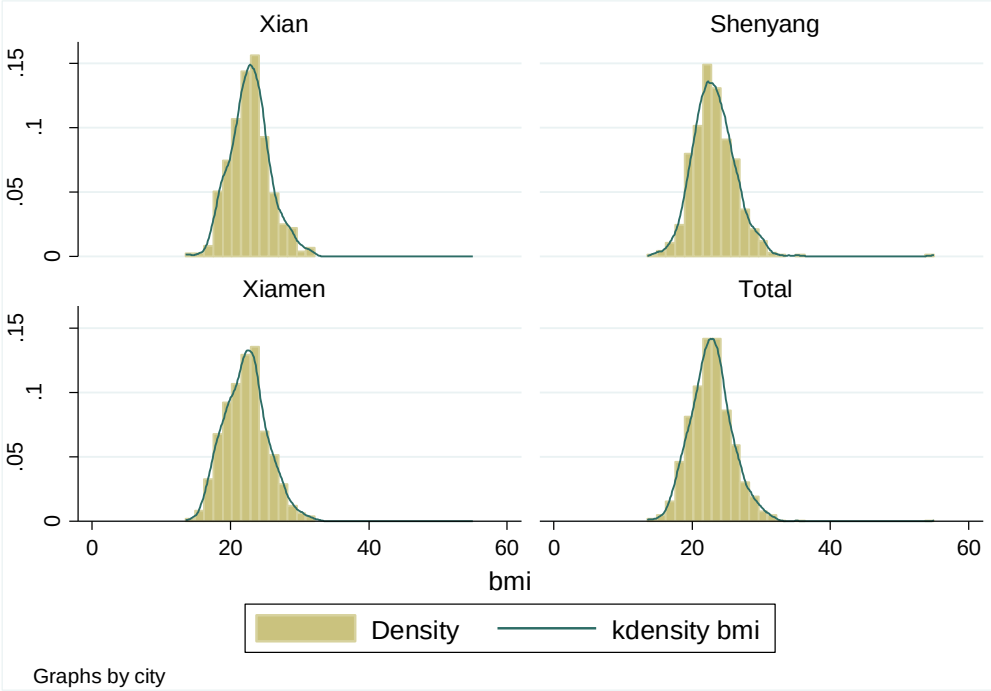

Figure A.1. BMI Distribution by city
Source: Calculated by Author, 2013

Table A.1. Employment status of sample individuals (Percent)

	full-time	part-time	retired	homeworker	unemployed	student	other	Total
Total	56.3	0.7	28.2	4.8	5.4	4.1	0.5	100
Xian	60.8	0.2	25.8	2.8	4.7	5.1	0.6	100
Shenyang	54.1	0.8	33.3	1.9	5.4	4.3	0.2	100
Xiamen	52.8	1.4	24.7	11.5	6.3	2.5	0.8	100

Table A.2. Smoking status of sample individuals (Percent)

	smoking	quit smoking	never	Total
Total	23.0	5.2	71.8	100
Xian	26.9	4.5	68.6	100
Shenyang	22.4	3.9	73.7	100
Xiamen	18.1	7.7	74.2	100

Table A.3. Summary statistics of consuming FAFH sample

Variable	Description	Obs	Mean	SD	Min	Max
bmi	Kg/m^2	917	22.80	3.12	13.54	55
categoryc	Chinese criteria	917	1.30	0.67	0	3
categoryw	WHO criteria	917	1.15	0.54	0	3
restaurant	# meals at full service restaurant/week	917	1.23	1.82	0	14
fastfd	# meals at fast food outlet/week	917	1.45	2.33	0	16
cafeteria	# meals at cafeteria/week	917	2.46	3.74	0	21
gender	1=male	917	0.52	0.50	0	1
age	Years	917	43.28	13.51	18	90
couple	1=married	917	0.81	0.39	0	1
nchild	# of children<18 in HH (persons)	917	0.42	0.52	0	2
college	1=college+	917	0.54	0.50	0	1
pcawkinc	per capita weekly HHincome (1000 yuan)	917	0.50	0.30	0.08	3.69
employ	employment status					
	full-time (1=yes)	917	0.69	0.46	0	1

(continued)

Table A.3. Summary statistics of consuming FAFH sample (continued)

Variable	Description	Obs	Mean	SD	Min	Max
	part-time (1=yes)	917	0.01	0.09	0	1
	retired (1=yes)	917	0.18	0.39	0	1
	homeworker (1=yes)	917	0.03	0.18	0	1
	unemployed (1=yes)	917	0.03	0.18	0	1
	student (1=yes)	917	0.05	0.22	0	1
smoke	smoking status	917	2.45	0.87	1	3
	currently smoking (1=yes)	917	0.25	0.43	0	1
	never (1=yes)	917	0.71	0.46	0	1
prac	times/month	917	9.03	12.10	0	60
disease	1=HH has member with dietary problems	917	0.65	0.48	0	1
Xian	1=yes	917	0.41	0.49	0	1
Shenyang	1=yes	917	0.35	0.48	0	1
Xiamen	1=yes	917	0.24	0.42	0	1