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**Policy and Institutional Reforms to Improve Horticultural Markets in Pakistan  
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**Food consumption Pattern Change and Horticulture Consumption in  
China**

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**Abstract**

The overall goals of this study are to have a better understanding of change of horticultural consumption and its major driving forces in China. Using three survey datasets collected by NSBC and CCAP, this paper examines the determinants of horticultural consumption for rural and urban households in China, and investigates how horticultural consumptions change in response to income growth in future. The results show that rural and urban consumers have similar per capita vegetable consumption, but per capita fruit consumption of urban households is much higher than that of rural households. The changing pattern of horticultural consumption is different between urban and rural households. Our analyses also find that China's horticultural consumptions have been underestimated in the existing literature for both rural and urban in all regions. It reveals a trend of increasing per capita horticultural crops, particularly fruit consumption in future. Moreover, the structure of horticultural consumption would upgrade and diversify to satisfy the increasing demand for quality food, which supply great market space for international horticultural exporters, such as Pakistan.

**Keywords**

China, Horticulture Demand, Household Consumption, Elasticity

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## 1. Introduction

Horticultural products are the most important sources of vitamin intake, and their production have experienced gradually rising trend in China. At the same time, horticultural net exports have maintained competition in global market in the past decade. However, based on NSBC's Household Income and Expenditure Survey (HIES), per capita vegetable and fruit consumption has been stagnant since the middle 2000s (Figure 1). Given only 0.5% of average annual growth of population in 2000-2015, it is puzzling to see how horticultural supply (production + net import) data can match with horticultural consumption data in China. While the quality of production data is doubted by many, the inconsistency between horticultural supply and demand data might also come from the underestimation of horticultural consumption in HIES.

Although there are numerous studies on food consumption in China, most studies were conducted 10 years ago. Most early studies and a few recent ones have argued that horticultural consumptions have high income elasticities and the consumption would increase rapidly as income increased (Fan et al., 1995; Liu and Zhong, 2009; Zheng and Henneberry, 2010; Zhang et al, 2013). However, there is a great disparity in income elasticities of horticultural consumptions, which range over 0.4-0.8 for vegetables and 0.5-1.0 for fruits. Furthermore, the estimated income elasticities of horticultural consumptions are inconsistent with the stagnant trend of horticultural consumptions suggested by the NSBC statistical data.

Moreover, to our knowledge, no empirical study has investigated horticultural consumption away from home (AFH). HIES records mainly food consumption at home in both quantity and expenditure. While food consumption away from home (AFH) in expenditure is also recorded, data on quantity by major food groups are not available. In addition, data on expenditure for food consumption AFH in HIES cover only part of food consumption that is paid by the consumer, excluding those paid by consumer's institution and others sources. Food consumption AFH is an important part of food consumption because it has been rising significantly over time in China (Ma et al., 2006; Bai et al, 2010; Huang et al, 2013).

Major research issues examined in this study include the following. Has China's horticultural consumption been underestimated? How significant is the horticultural consumption away from home? Has per capita horticultural consumption decreased? What are the major driving forces affecting horticultural consumption? What are the prospects of horticultural consumption in the future? Is there market space for international horticultural exporters, such as Pakistan?

The overall goals of this study are to have a better understanding of change of horticultural consumption and its major driving forces in China. Specifically, we achieve this goal through the following three objectives: 1) To document major characteristics of horticultural consumption in China; 2) To examine the major factors affecting horticultural consumption, for example income, urbanization, and consumption pattern (e.g., consumption away from home) and/or preference change among different consumers; and 3) To generate the likely research and policy implications in the future. Answering these questions is important for a better understanding of horticultural consumption behaviors in rural and urban areas and the research and policy implications in the future. To answer the questions listed above, we

use three survey datasets in China: NSBC HIES household level data for 2005, CCAP's urban household survey in 11 cities for 2007-2012 and CCAP's rural household survey in Guangdong province for 2014.

In the next section, we introduce the data used in this study. Section 3 discusses horticultural consumptions of rural and urban households and their correlations with income. Section 4 presents the econometric models and estimation procedure. The estimated results on the impacts of income on per capita horticultural consumption, horticultural consumption AH and AFH are discussed in section 5. The final section concludes this study.

## **2. Data and sampling methods**

Three survey datasets are used in this study and each of them focus on different aspect of horticultural consumption in China: 1) rural and urban HIES from National Bureau Statistical (NSBC) for urban and rural horticultural consumption AH, or NSBC household survey; 2) urban household survey in 11 cities from CCAP for urban horticultural consumption for both AH and AFH consumption; 3) rural household survey from CCAP in Guangdong province for horticultural rice consumption AH and AFH. We successively describe these data in detail.

### **Dataset 1: NSBC urban and rural household survey, 2005**

The data set used for this study was collected by NSBC for urban and rural households in 31 provinces of China in 2005. The NSBC conducts a nationwide urban household survey annually. As an official statistical activity, the NSBC household survey collects extensive socioeconomic information on income, food consumption, and demographics etc. Unlike most income and expenditure surveys that cover only a short period, the urban household survey in China captures expenditures and consumptions through a diary kept by the chosen households over the course of an entire year. These households are selected by NSBC and represent the households belonging to various income classes.

Households report their food expenditures and the physical quantities that pertain to their food consumption in the survey diary. The prices paid by the households are calculated by dividing the consumer expenditures on a food product by its corresponding quantity. Hence, the price calculated in this manner (unit value) is household specific, representing household purchase decisions. Not all households purchased all food products during the survey period. If expenditure or quantity is missing for some household consumption items, the quality-adjusted price is equal to the regional (city or town) average price for the consuming households in that region.

The survey covers over 68,000 urban households and 13,000 rural households. After omitting the households with outlier calorie intake, the data for 12,972 urban households and 56,396 rural households are used for this study.

Unfortunately, this data has two obvious shortcomings: first and more importantly, food consumption in this data is underreported and the rise in food consumption AFH -one of the main sources of undercounting of food consumption- is neglected (Ma et al., 2006). Second, this data was collected 10 years ago as more recent NSBC data is not available. To overcome these shortcoming we use other two data from urban and rural

household surveys conducted by CCAP.

### **Dataset 2: CCAP city household survey, 2007-2012**

This dataset includes 2,320 households surveyed by CCAP in 11 Chinese cities in different years during 2007-2012. City is different from urban areas as urban areas also include the urbanized rural townships in China. These cities are geographically dispersed across the country. The households in our survey are selected by a stratified random sampling approach from households participating in the NSBC survey in each city.

The survey instrument used to obtain data for this study includes two parts. The first part collected detailed information on demographics and socioeconomics of the household and was carried out by enumerators with in-house, and face-to-face interviews. The second part of the survey collected food consumption information. During the survey, enumerators explained the instructions for the second part and demonstrated to respondents how to record every family member's food consumption and expenditures. Part two was then left with the respondent for one week (including the drop-off day) for diary-based recording. The selected households were asked to record their consumption of and expenditures on food consumed away from home and prepared at home as well as related information, such as who paid for each meal, type of food facility, purchase venue etc.

Food consumptions AFH in our survey is defined to include expenditures on all foods that are purchased at restaurants, fast food outlets, cafeterias and other venues such as street vendors. It also includes food consumptions AFH that are free, hosted by friends or relatives, or are provided by work units. The value of these foods is estimated by the respondents as if they paid. Detailed information on demographics and socioeconomics of the household are also collected in the survey. After omitting observations with missing records on food consumptions, the data for 2,127 households is used in this paper. All expenditure and income are discounted in to 2012 by annual urban CIP.

### **Dataset 3: CCAP rural household survey, 2014**

This dataset is from a rural household survey conducted by CCAP in 2014 in Guangdong, a southern province of China. Six counties with three townships from each county and three villages from each township were randomly selected. In total, the sample covers 54 villages, and, in each village, 10 households are randomly sampled.

For each household, we collected detailed data including the disposable income per capita in 2014, household characteristics, and daily food consumption in the past three days. In addition to basic information, household characteristics also include income, durable consumable assets valued at more than 500 Yuan at the time of survey, and types of agricultural commodities produced during the past 12 months. As to daily food consumption, we collected data on food consumption at home (AH) and away from home (AFH) by food item and by each meal for each of the past three days. Definition of food consumption AFH in Dataset 3 was the same as in Dataset 2 as discussed above.

Finally, after checking and cleaning the surveyed data, we excluded 14 households that had incomplete data on food consumption in the past three days. At the end of this

process, we had a sample that includes 526 rural households and 2,652 household members.

### **3. Characteristics and patterns of horticultural consumption in China**

Before analyzing the horticultural consumption patterns, we sorted all households according to their annual per capita income and then divided the whole sample into five equal sized groups: Q1 to Q5. Q5 is the highest income households, and Q1 is the lowest income households. We compare annual horticultural consumption per capita by rural and urban locations and by income groups. Due to different importance of self-produced horticultural products, the vegetable consumptions for urban household are moderately lower than those of rural households. But the urban households' fruit consumptions are much higher than those of rural households due to higher income levels of urban households.

Both per capita vegetable and fruit consumptions AH have slightly positive association with income increase, but the per capita vegetable consumptions AH have more rapid growth as income increases from one income group to other. Among the household groups, Q5 has the highest vegetable consumptions AH, while Q1 has the lowest vegetable consumptions AH. Although compared to the lowest income households (Q1), the per capita vegetable consumption AH for the households with higher income (Q2-Q4) is higher (row 3-4, Table 1). But per capita vegetable consumption AH of the Q1 group are similar for urban and rural households, the growth of rural households' per capita vegetable consumption AH is higher than those of urban households. The growth of rural households' per capita fruit consumption AH is higher than those of urban households, per capita fruit consumptions AH of urban households are much higher than those of rural households. In CCAP surveyed cities, per capita vegetable consumptions AH of Q5 are lower than the consumption of Q4, which has the highest per capita vegetable consumptions AH among income groups.

But we could observe similar increasing trend of per capita fruit consumptions AH in CCAP surveyed cities among Q1-Q5 groups. We can also find the same pattern of horticultural consumption AH in rural Guangdong (row 2, Table 5) as that in data set 1 (row 2, Table 3).

We also observe the positive relation between per capita horticultural consumption AFH and per capita income in surveyed cities and rural Guangdong. For the surveyed cities in 2007-2012, compared to households with low income (Q1 and Q2 groups), households with higher income (Q3-Q5 groups) have much more vegetable and fruit consumptions AFH (row 1 and 4, Table 3). So much so that the Q5 group has more than twice the vegetable and fruit consumptions AFH than that of the Q1 group. Moreover, as for households in rural Guangdong (Table 5), per capita vegetable consumption AFH is observed to be positively associated with per capita income increase (row 1, Table 5). However, a clear trend of per capita fruit consumption AFH cannot be observed from Table 5 due to scarce fruit consumptions AFH of rural households.

Considering the big proportion of horticultural consumption AH in total horticultural

consumption, total horticultural consumption suggested a similar association to horticultural consumption AH. The higher-income group would have higher per capita total vegetable and fruit consumptions. The only exception is per capita total vegetable consumption in surveyed cities.

In addition, the prices of horticultural consumption are mostly positively associated with per capita income. Compared with low-income households, richer households have higher horticultural consumption price for consumption AH or AFH (Table 2, and 4). That may be due to the facts that richer households would eat high-quality and high-price horticultural products and have horticultural consumption at more luxurious locations, where horticultural products are sold more expensive.

A multivariate framework is needed to further analyze the impacts of driving factors, such as income, urbanization, food preference, household characteristics, on per capita horticultural consumptions by location and by rural and urban region, which we describe in the next section.

#### 4. Model specification and estimation procedures

To evaluate the impacts of driving forces on per capita horticultural consumptions for rural and urban household, we apply a multivariate analytical framework. To do this, we first specify a nonlinear econometric model to estimate the impacts of income change on per capita total horticultural consumption and horticultural consumption AH. Second, we use a quadratic model to estimate the determinants of per capita horticultural consumption AFH. All horticultural consumptions and disposable income are measured on an annual per capita level.

For per capita total horticultural consumption and rice consumption AH, the following empirical model is applied to all three survey datasets respectively:

$$\ln q_i = \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln P_i + \sum_k \alpha_3 Z_{ik} + \sum_j \alpha_4 D_{ij} + u \quad (1)$$

where  $i$  is household index and  $\ln q$  is annually per capita total horticultural consumption or horticultural consumption AH specified in logarithmic form. On the right-hand side,  $Y$  refers to annually per capita disposable income in the survey year, and its logarithmic form are included in the equation (1) to capture the nonlinear impacts of income change. The log function of  $P$ , the horticultural price, is included in the right hand side of the above equation.  $Z$  is a vector with a set of household characteristics.  $D$  is a vector of region dummy variables representing surveyed province, county or city. The  $\alpha$ 's are coefficients to be estimated. Finally,  $u_i$  is the error term that satisfies  $E(u_i) = 0$ .

After estimation of equation (1), the income elasticities of total horticultural

consumption or horticultural consumption AH could be calculated using the following equation:

$$e = \alpha_1 \quad (2)$$

where  $e$  is income elasticity of total horticultural consumption or horticultural consumption AH. The equation (1) is estimated for per capita total horticultural consumption and consumption AH using OLS for households, and both OLS and Tobit for households<sup>1</sup>.

For per capita horticultural consumption AFH, a Tobit estimation of the equation (1) and equation (3) are used for dataset 2 and dataset 3, accounting of the fact that many zero values of consumption are found in per capita horticultural consumption AFH. The model (3) specification is the same as equation (1) except for annual income per capita in original and quadratic form included in the right-hand side of the equation:

$$q_i = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln P_i + \sum_k \beta_3 Z_{ik} + \sum_j \beta_4 D_{ij} + u \quad (3)$$

The equation (3) is estimated using Tobit model to account for the censored consumption. Similarly, to the equation (1), the income elasticities of horticultural consumption AFH could be calculated using the equation (4) (Woodridge, 2009):

$$e = (\beta_1 + 2\beta_2 \bar{Y}) * \Phi(\beta X / \sigma) / (\bar{Y}) \quad (4)$$

where  $e$  is income elasticity of horticultural consumption AFH;  $\bar{q}$  is the mean value of annual per capita horticultural consumption;  $\beta$  is a vector of coefficient to be estimated;  $X$  is a set of all variables on the right hand side of equation (4);  $\Phi$  is the standard normal distribution function;  $\sigma$  is standard deviation of the regression.

## 5. Results for determinants of horticultural consumptions

The regression results on per capita horticultural consumption estimated by OLS and Tobit models are reported in Tables 7-14. Based on the estimated coefficients, we can estimate income and price elasticities of total horticultural consumption, horticultural consumption AH and AFH. In general, most of the multivariate findings are consistent with the descriptive results from Table 1-6; however, the regression results presented in Tables 7-16 provide more in-depth findings on how the income growth affect per capita total horticultural consumption, horticultural consumption AH and AFH, which are, 1) Income elasticities of per capita horticultural consumption are estimated to be positive; 2) Both urban and rural households' income elasticities of fruit consumption are higher than those of vegetable consumption, either for total horticultural consumption or

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<sup>1</sup> There exist many zero horticultural consumptions. The Tobit estimated income elasticity of horticultural consumption is  $e = \left( \alpha_1 - \frac{\alpha_2}{\bar{Y}} \right) * \Phi(\beta X / \sigma)$ .

horticultural consumption AH/AFH. 3) Both urban and rural households' income elasticities of horticultural consumption AFH are higher than those of horticultural consumption AH.

The impacts of income growth on per capita total horticultural consumption is quite different between vegetable and fruit, both for urban and rural households. As expected, the income elasticities are positive and price elasticities are negative. Urban and rural households' income elasticities of vegetable consumption AH are estimated to be close to 0.2 and statistically significant (column 1, Table 8). The results indicate that both urban and rural household will increase their per capita vegetable consumption AH as their income increases. On the other hand, the rural households' income elasticity of total vegetable consumption AH (0.891) is estimated to be higher than urban households' (0.617), meaning that compared to urban households, rural households have more rapid growth of fruit consumption AH in response to income growth.

As for city households, their income elasticity of vegetable consumption AH is slightly negative and statistically significant. This may be due to the inclusion of big city households in CCAP city household survey other than those living in small and medium cities and towns. Because of high income and urban life-style, the people living in big cities would have eaten higher quantities of food away from home and thus decreasing food at home. The city households' income elasticity of fruit consumption AH is also lower than the estimation from data set 1 but statistically significant and positive (0.335). Moreover, income elasticities of vegetable consumption AH for rural households in Guangdong are positive but statistically insignificant (row 1, Table 14). This may be explained by the fact that most of their consumed vegetable are produced by themselves, and the households with higher income would diversify their food consumptions rather than spending more income on staple food and vegetables. We could infer the income elasticity of fruit consumption AH for total fruit consumption, which is positive and statistically significantly. In conclusion, per capita vegetable consumptions AH would increase slightly as income increase, and simultaneously per capita fruit consumptions would rise rapidly.

Our results further show that horticultural consumptions AFH have positive income elasticities in urban and rural areas. City households have positive and statistically significant income elasticity of fruit consumption AFH (0.437), which is slightly higher than their income elasticity of vegetable consumption AFH (0.371, column 3, Table 11). This fact suggests that the both vegetable and fruit consumption AFH of city households would rise rapidly as income increases. Compared to city households, rural households have much large, positive, and statistically significant income elasticity of vegetable consumption AFH (0.808). Though the ratio of vegetable consumption AFH for rural households is too low to be evaluated by econometric model, we could expect a quite high income elasticity of fruit consumption AFH. In conclusion, both urban and rural households' horticultural consumption AFH would increase rapidly with the increase in income in future.



## 6. Concluding remarks

Using three survey datasets collected by NSBC and CCAP, this paper examines the determinants of horticultural consumption for rural and urban households in China, and investigates how horticultural consumptions change in response to income growth in future.. The results show that rural and urban consumers have similar per capita vegetable consumption, but per capita fruit consumption of urban households is much higher than that of rural households. The changing pattern of horticultural consumption is different between urban and rural households. Per capita Vegetable consumption AH have low income elasticities for both urban and rural households, and urban households' per capita vegetable consumption AH has been falling. Per capita fruit consumptions AH of both urban and rural households are rising rapidly with the income growth. Moreover, horticultural consumptions AFH have high, positive, and statistically significant income elasticities for both rural and households indicating a potential for continuous high demand trend in future.

Our analyses do show that China's horticultural consumptions have been underestimated in the existing literature for both rural and urban in all regions. There has been rising trend of horticultural consumptions away from home. Considering the horticultural consumptions AFH would raise the level of per capita total horticultural consumptions of both rural and urban households. However, despite the stagnant horticultural consumption AH, our analysis reveal a trend of increasing per capita horticultural crops, particularly fruit consumption in future.

Moreover, the structure of horticultural consumption would upgrade and diversify to satisfy the increasing demand for quality food, which supply great market space for international horticultural exporters, such as Pakistan.

The increasing demand for horticultural products by China's consumers provide opportunity for exports from neighboring countries like Pakistan. This is especially true as China's domestic expansion in production is limited by resource constraints such land and water, particularly for in fruit in the long term. We not that China would continue to export temperate fruits to other countries while its demand for imported tropical horticultural crops will increase. Our analysis (in the paper on CPEC) shows there was little export of fruits from Pakistan to China, and they were limited to only dry nuts. With China-Pakistan Economic Corridor fast taking its shape in Pakistan and the ensuing improvements in land connectivity between the neighboring countries, we expect that the future trade in horticultural products will improve significantly. That would help Pakistan's horticultural markets.

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**Table 1. Per capita horticultural consumption AH (kg) by income groups in rural and urban China in 2005**

	All samples	Q1	Q2	Q3	Q4	Q5
Vegetable						
Rural	139.9	100.5	130.4	147.4	158.3	162.7
Urban	121.4	100.9	117.2	123.3	131.7	133.7
Fruit						
Rural	22.8	13.5	18.0	21.5	26.3	34.9
Urban	65.2	39.6	55.3	65.6	76.3	89.0

Source: NSBC household survey, 2005

**Table 2. Horticultural consumption AH prices (Yuan/kg) by income groups in rural and urban China in 2005**

	All samples	Q1	Q2	Q3	Q4	Q5
Vegetable						
Rural	1.2	1.1	1.1	1.1	1.2	1.3
Urban	2.3	2.0	2.2	2.3	2.4	2.7
Fruit						
Rural	2.3	2.0	2.1	2.2	2.3	2.7
Urban	3.4	3.0	3.2	3.4	3.6	4.0

Source: NSBC household survey, 2005;

**Table 3. Per capita horticultural consumption by income group in cities in 2007-2012 (Kg/Year)**

	All samples	Q1	Q2	Q3	Q4	Q5
Vegetable						
AFH	22.6	16.4	18.4	21.1	24.1	33.5
AH	140.8	140.4	141.8	141.9	144.7	135.2
Total	163.4	156.8	160.2	163.0	168.8	168.7
Fruit						
AFH	3.8	2.7	2.6	3.3	4.8	5.9
AH	88.4	83.6	85.5	88.9	90.9	93.2
Total	92.2	86.3	88.1	92.2	95.8	99.1

Source: CCAP city household survey, 2007-2012

**Table 4. Horticultural consumption prices by location and income groups in cities in 2007-2012 (Yuan/kg)**

	All samples	Q1	Q2	Q3	Q4	Q5
Vegetable						
AFH	10.7	10.6	10.8	10.8	10.8	10.7
AH	5.4	5.0	5.3	5.5	5.6	5.9
Total	6.2	5.5	5.9	6.2	6.4	6.8
Fruit						
AFH	9.2	9.1	9.2	9.3	9.1	9.3
AH	6.0	5.7	5.9	6.1	6.3	6.3
Total	6.2	5.8	6.1	6.2	6.4	6.6

Source: CCAP city household survey, 2007-2012

**Table 5. Per capita horticultural consumption by income groups in rural Guangdong in 2014 (Kg/Year)**

	All samples	Q1	Q2	Q3	Q4	Q5
Vegetable						
AFH	3.1	1.7	1.5	3.4	3.3	5.7
AH	151.3	138.5	150.8	146.2	155.5	165.1
Total	154.5	140.2	152.3	149.7	158.8	170.8
Fruit						
AFH	0.3	0.0	0.0	0.0	1.3	0.0
AH	25.5	15.4	11.8	23.3	24.3	52.2
Total	25.7	15.4	11.8	23.3	25.6	52.2

Source: CCAP rural household survey, 2014

**Table 6. Horticultural consumption price by location and income groups in rural Guangdong in 2014 (Yuan/kg)**

	All samples	Q1	Q2	Q3	Q4	Q5
Vegetable						
AFH	20.2	20.7	20.8	20.1	20.5	18.7
AH	4.5	4.5	4.3	4.5	4.3	4.7
Total	4.6	4.5	4.4	4.6	4.5	5.0
Fruit						
AFH	7.8	7.8	7.8	7.8	7.8	7.8
AH	7.6	7.6	7.7	7.4	7.5	7.9
Total	7.5	7.5	7.6	7.3	7.3	7.7

Source: CCAP rural household survey, 2014

**Table 7. OLS regression results for per capita total horticultural consumption and consumption at home (AH) in 2005**

	Log(q)			
	Vegetable		Fruit	
	Rural	Urban	Rural	Urban
Log(Y)	0.216*** (0.006)	0.213*** (0.011)	0.891*** (0.022)	0.617*** (0.011)
Log(P)	-0.197*** (0.008)	-0.670*** (0.085)	-1.149*** (0.022)	-0.628*** (0.024)
Family size	-0.124*** (0.003)	-0.089*** (0.006)	-0.108*** (0.010)	-0.105*** (0.008)
Age groups				
Age 16-36	0.189*** (0.015)	0.170*** (0.026)	-0.499*** (0.056)	-0.042 (0.032)
Aged 36-50	0.176*** (0.021)	0.290*** (0.026)	-0.725*** (0.073)	-0.025 (0.031)
Aged over 50	0.180*** (0.018)	0.571*** (0.023)	-0.946*** (0.064)	0.023 (0.028)
City dummy variables		Included but not reported		
Constant	3.084*** (0.071)	3.154*** (0.096)	-2.495*** (0.226)	-0.355*** (0.112)
Observations	56,396	12,972	56,396	12,972
R-squared	0.381	0.265	0.173	0.346

Note: Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 8. The estimated income and price elasticities of per capita horticultural consumption at home (AH) in 2005**

	Income elasticities	Price elasticities
Vegetable		
Rural	0.216***	-0.197***
Urban	0.213***	-0.670***
Fruit		
Rural	0.891***	-1.149***
Urban	0.617***	-0.628***

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 9. The OLS estimated results for per capita total horticultural consumption and consumption at home (AH) in Chinses cities**

	Log(q)			
	Vegetable		Fruit	
	Total	AH	Total	AH
Log(Y)	0.048** (0.022)	-0.087*** (0.033)	0.379*** (0.066)	0.335*** (0.072)
Log(P)	-0.323*** (0.040)	-0.131*** (0.035)	-1.301*** (0.093)	-1.128*** (0.089)
Family size	-0.062*** (0.014)	-0.006 (0.021)	0.061 (0.041)	0.080* (0.045)
Ratio of male population	0.141*** (0.052)	0.166* (0.095)	-0.222 (0.177)	-0.252 (0.196)
Age groups				
Aged 16-36	0.064 (0.079)	-0.010 (0.127)	-0.888*** (0.232)	-0.964*** (0.253)
Aged 36-50	0.226*** (0.074)	0.471*** (0.114)	-0.750*** (0.223)	-0.726*** (0.243)
Aged over 50	0.112 (0.076)	0.532*** (0.115)	-0.829*** (0.233)	-0.701*** (0.252)
Wife have full-time job (1=Yes; 0=No)	-0.034 (0.025)	-0.108*** (0.035)	-0.197*** (0.073)	-0.236*** (0.080)
Wife have high-school education (1=Yes; 0=No)				
Province dummy variables		Included but not reported		
Constant	5.262*** (0.186)	5.461*** (0.261)	4.142*** (0.562)	3.831*** (0.612)
Observations	2,127	2,127	2,127	2,127
R-squared	0.137	0.127	0.158	0.127

Note: Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 10. The Tobit estimated results for per capita total horticultural consumption and consumption at home (AH) in Chinses cities**

	Vegetable	Fruit
Log(Y)	10.958*** (1.540)	4.761*** (1.012)
Log(P)	-37.466*** (3.313)	-33.622*** (4.487)
Family size	-2.365*** (0.837)	0.355 (0.526)
Ratio of male population	0.604 (4.128)	0.994 (2.383)
Age groups		
Aged 16-36	2.335 (5.017)	-7.367** (3.451)
Aged 36-50	-12.629** (4.961)	-8.122*** (3.141)
Aged over 50	-38.904*** (5.028)	-19.641*** (3.501)
Wife have full-time job (1=Yes; 0=No)	6.713*** (1.520)	2.416** (1.035)
Wife have high-school education (1=Yes; 0=No)	3.390** (1.673)	0.918 (1.037)
Cities dummy variables	Included but not reported	
Constant	43.586*** (15.424)	45.160*** (12.781)
Sigma	28.757*** (1.541)	16.392*** (1.068)
Observations	2,127	2,127

Note: Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 11. The estimated income and price elasticities of per capita horticultural consumptions in Chinese cities**

	Total	AH	AFH
Vegetable			
Income elasticities	0.048***	-0.087***	0.371***
Price elasticities	-0.323***	-0.131***	-1.269***
Fruit			
Income elasticities	0.379***	0.335***	0.437***
Price elasticities	-1.301***	-1.128***	-3.089***

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 12. The estimated results for per capita vegetable consumptions in rural Guangdong**

	Total	AH	AFH
Log(Y)	0.015 (0.021)	0.002 (0.023)	8.570*** (2.482)
Log(P)	-0.187*** (0.047)	-0.165*** (0.050)	-34.497*** (3.748)
Family size	-0.065*** (0.011)	-0.067*** (0.012)	1.572 (0.980)
Ratio of male population	0.001 (0.001)	0.002 (0.002)	-0.013 (0.098)
Age groups			
Aged 16-36	0.004*** (0.001)	0.004*** (0.001)	-0.099 (0.128)
Aged 36-50	0.003** (0.001)	0.001 (0.002)	-0.017 (0.134)
Aged over 50	0.002 (0.001)	0.001 (0.001)	-0.065 (0.119)
County dummy variables	Included but not reported		
Constant	5.142*** (0.181)	5.169*** (0.196)	18.109 (21.149)
Sigma			22.308*** (2.133)
Observations	526	526	526
R-squared	0.234	0.078	

Note: Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Table 13. The estimated results for per capita total fruit consumption Away from Home (AFH) in rural Guangdong**

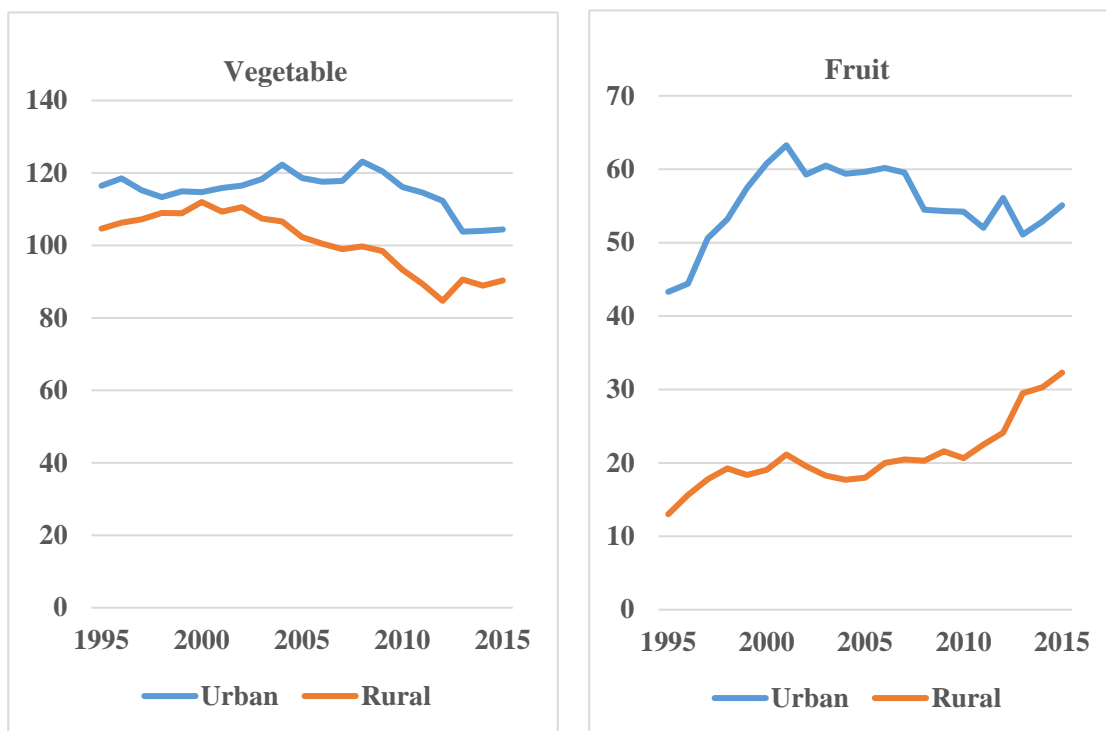
	Log(q)	q
Log(Y)	0.270 (0.193)	8.339* (4.996)
Log(P)	-3.794* (1.963)	-28.497* (16.649)
Family size	-0.022 (0.095)	-0.927 (1.893)
Ratio of male population	0.003 (0.009)	0.019 (0.212)
Age groups		
Aged 16-36	-0.015 (0.011)	-0.372* (0.225)
Aged 36-50	-0.017 (0.011)	-0.381 (0.238)
Aged over 50	-0.016 (0.011)	-0.393* (0.221)
County dummy variables	Included but not reported	
Constant	1.209 (4.546)	-22.940 (56.367)
Sigma		43.585*** (4.446)
Observations	526 OLS	526 Tobit

Note: Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 14. The estimated income and price elasticities of per capita horticultural consumptions in rural Guangdong**

	Total	AH	AFH
Vegetable			
Income elasticities	0.015	0.002	0.808***
Price elasticities	-0.187***	-0.165***	-3.253***
Fruit			
Income elasticities	0.422*		
Price elasticities	-1.443**		

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Figure 1.** Per capita horticultural consumptions of urban and rural households (kg) (1995-2015)