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China's Rural Household Demand for Fruit and Vegetables

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ABSTRACT

A two-stage budgeting LES-LA/AIDS system is used to estimate rural household demand in China with special emphasis on changes in demand for fruit and vegetable commodities across different income groups. The own-price elasticity for food was found to be more elastic than that for clothing, housing, durable goods, and other items. Within the food group, price elasticities range from −1.042 to −0.019. Grain, with an expenditure elasticity of almost unity, is an important staple food for the average rural household. Vegetables are important nonstaple foods relative to fruits. Lower value vegetables are the most price elastic in the vegetable group. Fruits are more price elastic than vegetables, with grapes being the most price elastic. Different income groups share a common demand function.

Key Words: AIDS model, Chinese rural households, elasticity, household demand, LES model, two-stage budgeting.

Since the mid-1980s, China consistently has been an important market for the world's agricultural exporters and especially for U.S. exporters. Total U.S. exports of agricultural products to China have increased four-fold since the early 1990s. Over this same period, U.S. exports of processed food products to China have increased eight-fold. U.S. exports of fruits and vegetables to China have increased even more rapidly, with average annual increases of more than 50% per year since the early 1990s. Given the importance of the Chinese market to the world market, and the U.S. in particular, projections of China's future food needs and changes in food consumption patterns have become increasingly important. Nearly all projections of China's future food demand predict an increase in food imports to meet the growing demand that is likely to result from an expanding population base and rapidly improving income levels.

The effects of changing household consumption patterns resulting from rapidly increasing household income on food demand have been the focus of a number of studies (Kueh; Lewis and Andrews; Huang and Rozelle; Halbrendt et al.; Fan, Cramer, and Wailes; Fan, Wailes, and Cramer; Guan; Liu, Wahl, and Mittelhammer). As China becomes more integrated into world agricultural markets, changes in China's food consumption patterns will become more important to world food markets, making information on food demand essential, especially given China's resource and technology constraints on food production.

This study focuses on the food consumption patterns, with special emphasis on fruits and vegetables, of China's rural households across different income groups and regions. Specifically, the goals of this study are to provide estimates of price and expenditure elas-

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ticities for fruits and vegetables. By examining household demand for fruits and vegetables by different income groups, we will determine whether they share a common demand function; whether expenditures on food increase more rapidly than expenditures on other broad commodity groups such as housing, clothing, durable goods, and other items (fuel, daily household goods, and services) in response to income; and whether fruits and vegetables are the most responsive to increases in food expenditures.

A two-stage budgeting model is used to estimate a complete demand system. Food, clothing, housing, durable goods, and other item demand is estimated in the first stage. In the second stage, grain, meat, leafy vegetables, root vegetables, other vegetables, dried vegetables, apples, grapes, other fruits and nuts, and other fruit demand is estimated.

Consumption Patterns

Seventy percent of China's population (1.2 billion, or nearly 23% of the world's population) lives in rural areas. Since the late 1970s and early 1980s, the incomes of China's rural population have dramatically increased in response to economic reforms which transformed a centrally controlled economy to a market economy. From 1979 through 1993, in real terms, per capita income and expenditure increased by over 13% per annum. Food consumption expenditures increased from 100 Yuan in 1980 to 447 Yuan in 1993 (in nominal terms).

Economic development brings changes in both the average level and the distribution of income and food consumption. As China experienced rapid, albeit uneven, growth in national income during the reform period, income inequality has increased since the mid-1980s. Comparing high (more than 1,000 Yuan), middle (between 500 and 1,000 Yuan), and low (below 500 Yuan) income per capita groups for 1993, the per capita food expenditure for a rural household was 1,027 Yuan in the high-income group, 747 Yuan in the middle-income group, and 600 Yuan in the low-income group. Per capita net income for the top 10% of rural households was five times that of the bottom 20% of rural households. However, in 1980, 77% of rural households had an average per capita income of 250 Yuan, and 23% of rural households had an average per capita income of 450 Yuan. Average per capita food consumption of the high-income group was 1.85 times that of the low-income group.

The structure of rural household consumption has dramatically changed. Farmers' consumption of purchased commodities has increased significantly. Prior to reforms in the early 1980s, expenditures on food ranked highest, followed by clothing and housing. Expenditures on staple foods were far higher than for nonstaple foods.

The Model

The two-stage budgeting procedure assumes that the consumer's utility-maximization decision can be decomposed into two separate steps. In the first stage, total expenditure is allocated across broad groups of commodities using a linear expenditure system (LES). The advantage of the LES is that it is simple and provides an intuitive economic interpretation, despite its strong separability assumption. The separability assumption is not overly restrictive for such commodities as food, housing, or clothing (Timmer and Aldermand). The LES functional form is specified as:

$$(1) \qquad P_I X_I = P_I R_I + \beta_I \left[Y - \sum_J P_J R_J \right],$$

with $0 < \beta_I < 1$, $\Sigma_I \beta_I = 1$, and $X_I > R_J$, where $P_I X_I$ is expenditure (P_I and X_I are aggregated price and quantity indices for commodities within group I), and R_J and β_I are parameters. Y is the total household expenditure.

In the second stage, group expenditures are allocated across individual commodities by using the Linear Approximate/Almost Ideal Demand System (LA/AIDS), developed by Deaton and Muellbauer. The model has been applied to micro-level data. The share equation for the LA/AIDS model is:

$$(2) \qquad \omega_{i,I} = \alpha_{i,I} + \sum_{j,I} \gamma_{ij,I} \log(p_{j,I}) + \beta_{i,I} \log\left(\frac{Y_I}{P_I}\right),$$

where $\omega_{i,I}$ is the budget share of good i in commodity group I, $p_{j,I}$ is the price of commodity j in group I, Y_I is the Ith group's total expenditure, and P_I is the Ith group's price index.

Data and Estimation

All major economic activities for 66,960 participating rural households are recorded by the National Rural Household Survey, conducted by the General Organization for Rural Household Surveys of the State Statistical Bureau (SSB). The sample contains 1,401 variables on the rural households' income, expenditures, production, and consumption, as well as their demographic characteristics. A 10% subsample of the survey observations is used in this study. In 1993, the National Rural Household Survey was substantially enhanced to include very disaggregated food items, such as fruits and vegetables, which are broken down into 10 types of fruits and 30 types of vegetables.

Five broad groups of goods are used in the first stage: food, clothing, housing, durable goods, and other items. Clothing includes cotton, synthetic fiber, wool, silk and satin, cloth knitwear, clothing, and household fabrics such as bedsheets and shoes. Durable goods include bicycles, sewing machines, clocks, wristwatches, electric fans, washing machines, refrigerators, sofas, wardrobes, writing desks, radios, television sets, VCRs, tape audio recorders, and cameras. The "other" items consist of the daily consumption of all goods and services (e.g., fuel and energy, education, entertainment, health care, etc.) other than food, clothing, housing, and durable goods. In the second stage, food expenditures are allocated among the following food items: grains, meat, other (stimulants, sweets, and cooking oils), leafy vegetables, root vegetables, other vegetables, dried vegetables, apples, grapes, other fruits and nuts, and others. Leafy vegetables include Chinese cabbage, cabbage, spinach, rape, celery, fragrant flowered garlic, green Chinese onion, hollow cabbage, asparagus, lettuce, and garlic bolt; root vegetables include radishes, carrots, ginger, and lotus root; other vegetables include cauliflower, cucumbers, wax gourd, onions, tomel gourd, tomatoes, eggplant, green peppers, bean sprouts, fresh kidney beans, and others; dried vegetables include day-lily, edible fungus, Tremella, xianggu mushrooms, and others. Other fruits and nuts include pears, bananas, oranges, pineapples, peaches, persimmons, nuts, and kernel products.

Since durable goods and housing are not completely consumed within one year, it is assumed that the annual consumption values of the durables are 20% for bicycles, sewing machines, and radios; 10% for washing machines, refrigerators, black and white television sets, tape recorders, cameras, and furniture; and 5% for motorbikes, color television sets, and VCRs. The rental value of housing is used instead of the total value of a housing expenditure for one year, a procedure that will bias the consumption results. The rental housing value is 5% of the total year-end value of the house. For households which have no recorded house value in the data sample, house rent is generated by a rental mean at the provincial level from secondary sources.

Quantities, expenditures, and sales are used to generate implicit values for individual commodities. The aggregated prices for the grouped goods—such as food, clothing, housing, durable goods, and other items in the first stage, and grains, meat, others (stimulants, sweets, and cooking oils), leafy vegetables, root vegetables, other vegetables, dried vegetables, other fruits and nuts, and others in the second stage—are computed using Stone's index with expenditure shares as weights for each group.

During the survey year, not every household in the sample consumed all 10 food items. The data sample indicates that 1.4% of households did not consume meat; 0.8% did not consume others (stimulants, sweets, and cooking oils); 0.2% did not consume leafy vegetables; 37% did not consume root vegetables; 2.8% did not consume other vegetables; 67% did not consume dried vegetables; 30% did not consume apples; 90% did not

Table 1. Rural Household Demand in China: Parameter Estimates and Comparison of Own-Price Elasticities and Expenditure Elasticities Across Income Groups for the First Stage, 1993

	Food	Clothing	Housing	Durable Goods	Other Items
Parameters					
β_I	0.614	0.056	0.046	0.105	0.180
	(132.810)	(40.720)	(27.690)	(50.610)	(54.100)
R_I	550.423	6.281	75.322	0.937	107.192
	(30.230)	(30.230)	(70.700)	(28.210)	(19.790)
Adjusted R^2	0.809	0.363	0.616	0.406	0.419
	---------- Price Elasticities ----------				
Nation	−0.844	−0.685	−0.210	−0.613	−0.699
I	−0.870	−0.732	−0.236	−0.554	−0.694
II	−0.850	−0.620	−0.189	−0.636	−0.672
III	−0.858	−0.625	−0.259	−0.675	−0.676
	---------- Expenditure Elasticities ----------				
Nation	1.026	0.929	0.585	0.977	1.151
I	1.071	0.978	0.561	0.885	1.082
II	1.064	0.764	0.510	0.918	1.120
III	1.051	0.858	0.692	0.818	1.102

Notes: I, II, and III denote high-, medium-, and low-income groups, respectively. Numbers in parentheses are *t*-ratios.

consume grapes; and 6% did not consume other fruits. To obtain consistent and asymptotically efficient estimates in the presence of zero consumption, a two-step estimation procedure is employed following Heien and Wessells. An inverse Mill's ratio is computed for each household in the first step, which is used as an instrument in the second stage.

Sample households are grouped into three income categories based upon per capita net income to test whether households in different income groups share a common food demand function. In the first stage, a nonlinear seemingly unrelated regression (SUR) estimator is used, and a linear SUR estimator is used in the second stage. Adding up, homogeneity, and symmetry restrictions are imposed for the food group in the second stage. The same model is estimated for each of the three income groups and their combinations, as well as for the entire national subsample in order to perform Chow tests for structural changes and for comparison.

Parameter Estimates and Elasticities

The estimated first-stage results for the broad groups are presented in table 1. Estimates and elasticities from regressions on the entire sample are reported hereafter, unless otherwise indicated. All parameters have expected signs and appropriate magnitudes, and are significant at the 1% level. Uncompensated price and expenditure elasticities are evaluated at the sample means. The own-price elasticity for food is −0.844 and is relatively more elastic than that for the other four groups (which range from −0.699 to −0.210). Expenditure elasticities for food (1.026) and other items (1.151) are slightly greater than unity, which indicates that as household income increases, demand for food and other daily household goods and services increases proportionally. Demand for housing is less elastic than demand for the other four groups with respect to both price (−0.210) and expenditures (0.585). This may reflect the fact that no well-behaved rural housing markets exist, and house construction is subject to various restrictions.

For comparison, estimates of own-price and expenditure elasticities for the five broad groups of goods are computed for the three income groups (table 1). Although own-price and expenditure elasticities for the five commodity groups are similar, demand for food, clothing, and other items is more elastic for

Table 2. Effect of Household Characteristics on Fruit and Vegetable Consumption in China's Rural Households, 1993

Variables	Grain	Meat	Other[a]	Leafy Veg.	Root Veg.	Other Veg.	Dried Veg.	Apples	Grapes	Other Fruit[b]
Education Level										
Illiterate	ns−	ns−	ns−	−	ns+	ns+	ns+	ns−	ns−	ns−
Elementary/High School	−	ns−	ns−	−	ns+	ns+	ns+	ns−	ns+	−
Children in the Household										
Age < 7	+	−	ns−	+	+	ns−	ns−	+	−	ns+
Age > 17	ns+	+	−	+	ns−	+	ns+	ns+	ns−	ns−
Eating Out	ns−	ns−	+	ns−	ns+	ns−	ns+	ns+	ns−	+
Household Size										
1 or 2	−	−	ns−	+	+	ns−	ns−	+	ns−	ns+
3	−	−	ns+	+	+	ns+	ns+	+	−	ns−
4	−	−	+	+	+	+	ns+	+	−	ns−
5 or 6	−	−	ns+	+	+	+	ns+	+	−	ns−
Off-Farm Employment	−	ns+	+	ns−	ns+	−	ns−	+	+	ns−
Working in Enterprises	−	−	+	ns−	ns−	ns+	ns+	+	ns−	ns+
Working in Township	+	−	ns−	ns−	+	+	ns−	ns−	+	ns+
Geographical Location										
Plains area	−	−	−	+	−	−	−	ns+	−	+
Hill area	−	−	−	−	+	ns−	ns−	ns−	−	+
Telephone	−	+	−	ns−	−	+	ns+	ns−	ns−	+
Road	−	−	−	−	+	ns+	ns+	ns+	−	ns+
Three Generations	−	+	+	ns+	ns−	ns+	ns+	ns+	ns+	ns+
North	+	−	+	+	+	−	+	+	+	−

Notes: + = significant at the .05 level and positive; − = significant at the .05 level and negative; ns+ = nonsignificant but exhibits a positive trend; ns− = nonsignificant but exhibits a negative trend.

[a] Other includes sweets, stimulants, and cooking oil.

[b] Other fruit includes bananas, oranges, pineapples, peaches, persimmons, watermelons, nuts, kernel products, and others.

higher income households than for lower income households.

In the second stage, most of the price coefficients for commodities within the food group are significant at the 1% level, except for a few cross-price parameters. All expenditure parameters are significant at the 1% or 5% levels. Many of the sociodemographic indicator variables in the model are significant (table 2). The implication is that differences in geographical location, topography, household type, and education level affect household consumption behavior. In general, as household size increased, vegetable consumption increased and meat and grain consumption decreased. As the number of roads increased, grain, meat, other food, and leafy vegetable consumption generally decreased, while root and other vegetables, as well as fruit consumption (except grapes) increased. Geographical location tended to have a negative effect on food consumption, while being in the northern region of China tended to have a positive effect. The presence of a telephone tended to have a negative effect on staple food consumption, but a positive effect on nonstaple foods. The findings indicate that the presence of a telephone resulted in increased meat consumption. These results may suggest that in areas with better infrastructure and communication (i.e., telephones, roads, etc.), markets are better developed and more and better quality products may be available on a more consistent basis.

Conditional price and expenditure elasticities are presented in table 3. All own-price elasticity estimates have appropriate signs. Own-price elasticities for grain, meat, and oth-

Table 3. Estimated Conditional Price and Expenditure Elasticities Within Food Groups in China's Rural Households, 1993

	Grain	Meat	Other[a]	Leafy Veg.	Root Veg.	Other Veg.	Dried Veg.	Apples	Grapes	Other Fruit[b]
	Conditional Price Elasticities									
Grain	**−0.784**	−0.123	−0.045	−0.103	−0.031	−0.067	−0.024	−0.023	−0.023	−0.002
Meat	0.237	**−0.019**	0.186	0.309	0.462	0.487	0.436	0.434	0.442	0.426
Other	0.071	−0.222	**−0.440**	0.060	0.098	0.226	0.130	0.145	0.131	0.154
Leafy Veg.	−0.136	−0.088	0.032	**−0.182**	0.046	−0.156	0.109	0.099	0.171	0.171
Root Veg.	−0.050	0.131	−0.083	−0.162	**−0.623**	−0.026	0.039	0.014	0.033	0.064
Other Veg.	0.024	0.226	0.251	−0.099	0.137	**−0.863**	0.504	0.156	0.156	0.057
Dried Veg.	−0.242	−0.236	−0.222	−0.214	0.069	−0.015	**−0.389**	0.107	0.100	0.066
Apples	−0.029	−0.135	0.162	−0.227	−0.100	−0.011	0.049	**−0.693**	0.055	−0.011
Grapes	−0.234	0.141	−0.229	−0.013	−0.021	−0.040	0.137	0.170	**−1.042**	0.137
Other Fruit	0.503	0.067	0.255	0.414	0.212	−0.311	0.171	0.158	0.175	**−1.011**
	Conditional Expenditure Elasticities									
	1.092	0.462	0.692	1.429	1.318	0.621	0.748	0.667	0.903	0.206

[a] Other includes sweets, stimulants, and cooking oil.

[b] Other fruit includes bananas, oranges, pineapples, peaches, persimmons, watermelons, nuts, kernel products, and others.

Table 4. Comparison of Conditional Own-Price Elasticities Across Income Groups in China's Rural Households, 1993

	Income Groups[a]			
Food Items	I	II	III	Nation
Grain	−0.656	−0.777	−0.791	−0.784
Meat	−0.031	−0.017	−0.014	−0.019
Other[b]	−0.409	−0.493	−0.475	−0.440
Leafy Vegetables	−0.488	−0.352	−0.076	−0.182
Root Vegetables	−0.665	−0.555	−0.666	−0.623
Other Fresh Vegetables	−0.905	−0.804	−0.918	−0.863
Dried Vegetables	−0.067	−0.450	−0.191	−0.389
Apples	−0.661	−0.657	−0.725	−0.693
Grapes	−1.078	−1.114	−0.996	−1.042
Other Fruit[c]	−1.289	−0.966	−0.258	−1.011

[a] I, II, and III denote high-, medium-, and low-income groups, respectively.
[b] Other includes sweets, stimulants, and cooking oil.
[c] Other fruit includes bananas, oranges, pineapples, peaches, persimmons, watermelons, nuts, kernel products, and others.

Table 5. Comparison of Conditional Expenditure Elasticities Across Income Groups in China's Rural Households, 1993

	Income Groups[a]			
Food Items	I	II	III	Nation
Grain	1.214	1.067	1.086	1.092
Meat	0.336	0.341	0.544	0.462
Other[b]	0.627	0.645	0.667	0.692
Leafy Vegetables	1.519	1.561	1.259	1.429
Root Vegetables	1.356	1.418	1.242	1.318
Other Fresh Vegetables	0.686	0.591	0.693	0.621
Dried Vegetables	0.796	0.714	0.688	0.748
Apples	0.712	0.555	0.754	0.667
Grapes	0.841	0.953	0.920	0.903
Other Fruit[c]	0.892	0.096	0.597	0.206

[a] I, II, and III denote high-, medium-, and low-income groups, respectively.
[b] Other includes sweets, stimulants, and cooking oil.
[c] Other fruit includes bananas, oranges, pineapples, peaches, persimmons, watermelons, nuts, kernel products, and others.

er are in a range of −0.784 to −0.019. The range of own-price elasticities for vegetables is −0.863 to −0.182, while the range for fruit is −1.042 to −0.693. The expenditure elasticity of grain (1.092) is near unity. Meat has a very low expenditure elasticity (0.462) and own-price elasticity (−0.019). Pork, beef, mutton, poultry and poultry products, seafood, and other meat products are aggregated into a single "meat" category, which may have contributed to the low price elasticity. Also, the level of market development, as reflected by the presence of infrastructure, may have resulted in a lower estimate. Leafy and root vegetables have very high conditional expenditure elasticities, 1.429 and 1.318, in both the food and vegetable groups. The own-price elasticity for leafy vegetables (−0.182) is very low. The income effect on households consuming leafy vegetables is larger than the price effect. The range of expenditure elasticities for fruit is 0.206 to 0.903. Grapes have the largest own-

Table 6. Comparison of Current Study Own-Price Elasticities with Other Relevant Studies

Food Items	Guan[a]	Liu et al.[b]	Fan et al.[c]	Halbrendt et al.[d]	Huang & Rozelle[e]	Chi(N)[f]	Chi(S)[g]	Current Study
Grain	−0.724			−0.233		−0.51	−0.54	−0.784
Wheat			−0.641					
Rice			−0.709		−0.200			
Meat			−0.384	−0.656	−0.292			−0.019
Pork	−0.769					−0.08	−0.13	
Poultry	−0.700			0.087				
Vegetables	−0.669		−0.409	−0.098	−0.258	−0.47	−0.28	
Leafy Vegetables								−0.182
Root Vegetables								−0.623
Other Fresh Veg.								−0.863
Dried Vegetables								−0.389
Fruit	−0.604			−0.316	−0.584	−1.25	−0.69	
Apples		−0.405						−0.693
Citrus		−1.205						
Grapes								−1.042
Peaches		−1.217						
Pears		−1.646						
Other Fresh Fruit		−1.160						−1.011

[a] Guan (1996), Northeast Coastal Region.
[b] Liu, Wahl, and Mittelhammer (1996), North and Northeast Regions.
[c] Fan, Wailes, and Cramer (1995).
[d] Halbrendt, Tuan, Gempesaw, and Dolk-Etz (1994).
[e] Huang and Rozelle (1990).
[f] Chi (1995), North Region.
[g] Chi (1995), South Region.

price elasticity (−1.042) and expenditure elasticity (0.903) in the fruit group.

Food Consumption Patterns Among Income Groups

Results of Chow tests for stationarity across the three income groups fail to reject the null hypothesis that households share a common food demand function at any conventional significance level. Conditional price and expenditure elasticities for major food items among the three income groups are presented in tables 4 and 5, respectively. Demand for most food items is less elastic with respect to price in higher income groups than in lower income groups. Among the three income groups, the own-price elasticity for grain is in a range of −0.656 to −0.791, while the own-price elasticity for meat is in a range of −0.014 to −0.031. Vegetables, including leafy, root, other, and dried vegetables, have own-price elasticities in a range of −0.067 to −0.918. Surprisingly, expenditure elasticities for most fruits and vegetables exhibit a non-monotonic change across the three income groups. Since provincial and household characteristic dummy variables have captured regional and demographic effects, the pattern of expenditure elasticities across the income groups raises the potentially interesting topic of dynamic changes in food demand responses to income changes.

Comparison of Elasticities to Previous Studies

Comparisons of own-price and expenditure elasticities to earlier studies are presented in tables 6 and 7, respectively. The expenditure elasticities from cross-sectional studies are generally larger than those from time-series studies for grain and its components, but the opposite is observed for meat, poultry, etc.

Table 7. Comparison of Current Study Expenditure Elasticities with Other Relevant Studies

Food Items	Guan[a]	Liu et al.[b]	Fan et al.[c]	Halbrendt et al.[d]	Huang & Rozelle[e]	Chi(N)[f]	Chi(S)[g]	Current Study
Grain	0.911			0.575		1.11	1.13	1.092
Wheat		0.589	1.092					
Rice		0.313	0.702		0.140			
Meat		1.783	1.271	1.092	0.046			0.462
Pork	0.978					0.24	0.57	
Poultry	0.995			1.273				
Vegetables	0.959		0.946	0.911	0.337	2.24	1.53	
Leafy Vegetables								1.429
Root Vegetables								1.318
Other Fresh Veg.								0.621
Dried Vegetables								0.748
Fruit	0.908			1.841	0.228	2.09	1.49	
Apples		0.133						0.667
Citrus		0.740						
Grapes								0.903
Peaches		1.440						
Pears		0.771						
Other Fresh Fruit		1.537						0.206

[a] Guan (1996), Northeast Coastal Region.
[b] Liu, Wahl, and Mittelhammer (1996), North and Northeast Regions.
[c] Fan, Wailes, and Cramer (1995).
[d] Halbrendt, Tuan, Gempesaw, and Dolk-Etz (1994).
[e] Huang and Rozelle (1990).
[f] Chi (1995), North Region.
[g] Chi (1995), South Region.

The estimated expenditure elasticities for grains in this study are much larger than those from previous studies for grains, but relatively smaller for meats—and may reflect the effects captured by regional and demographic effects. Own-price elasticities are inelastic, which is similar to those from other studies. Own-price elasticities for fruits and vegetables are, in general, between the estimates from both cross-sectional studies and time-series studies. The expenditure elasticities for fruits and vegetables in this study are relatively higher than those from time-series studies.

Conclusions

Empirical results indicate that China's rural household consumption behavior appears to be consistent with a two-stage budgeting system. Households choose to allocate their consumption expenditure across broad subcategories of expenditure such as food, and then to allocate their expenditure on food to individual food items such as fruits and vegetables.

The own-price elasticity for food is more elastic (−0.844) (table 1) than that for clothing, housing, durable goods, and other items. The expenditure elasticity for food is 1.026 (table 1), which is slightly greater than that for clothing, housing, and durable goods. Thus, as household income increases, the demand for food in rural China increases proportionally. The results of this study also suggest that grains are still important staple foods for the average rural household. Vegetables are important nonstaple foods relative to fruit. Lower-value vegetables are the most price elastic in the vegetable group. Fruits are more price elastic than vegetables, while grapes are the most price elastic. Larger expenditure elasticities for fruits and vegetables indicate that a rapid growth in income will increase demand for fruits and vegetables, and thus cause an

increase in production. Consequently, fruit and vegetable production will compete for resources such as arable land and fertilizers with cereal and feed grain production.

The results indicate that the hypothesis that rural households in different income groups share a common demand function cannot be statistically rejected. One of the most disconcerting aspects of the study concerns the large variation of the estimates of elasticities from previous studies, especially meat and grains. However, the results suggest that the level of infrastructure and communication development may significantly affect the demand for some products and may explain some of the variation from previous studies. The estimated results from a well-defined model and a rich data source contribute to the need for more precise parameters in predicting China's fruit and vegetable demand.

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