Household Vegetable Demand in the Philippines: Is There an Urban-Rural Divide?

Maria Erlinda M. Mutuc
Department of Agricultural and Applied Economics
Texas Tech University
P.O. Box 42132
Lubbock, TX 79409-2132
Phone: (806)742-2821; FAX: (806)742-1099
Email: maria.mutuc@ttu.edu

Suwen Pan
Department of Agricultural and Applied Economics
Texas Tech University
P.O. Box 42132
Lubbock, TX 79409-2132
Phone: (806)742-0261 ext 233; FAX: (806)742-1099
Email: s.pan@ttu.edu

Roderick M. Rejesus
Department of Agricultural and Applied Economics
Texas Tech University
P.O. Box 42132
Lubbock, TX 79409-2132
Phone: (806)742-0261 ext 253; FAX: (806)742-1099
Email: roderick.rejesus@ttu.edu

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ABSTRACT

A three-step estimation method and a Nonlinear Quadratic Almost Ideal Demand System (NQAIDS) are used to assess the vegetable demand behavior of rural and urban households in the Philippines. Detailed household consumption data for a number of vegetable commodities are utilized in the analysis. The results show that most of the expenditure and own-price elasticities of the vegetables analyzed are near or larger than unitary in both rural and urban areas. For majority of the vegetable commodities, there are no significant differences in the expenditure, own-price, and cross-price elasticities of urban households relative to rural households. Only demand for cabbage and tomatoes in the urban areas tend to be statistically different compared to rural areas. The demand behavior information gleaned from the analysis provides important insights that could help guide nutritional and public policies in rural and urban areas of the Philippines.

Keywords: Consumption Behavior; Demand Systems; Elasticities; Vegetable Demand

JEL Classification: R21; Q11

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1. Introduction

There have been a number of previous studies that examined food demand in the Philippines. However, empirical work focusing on vegetable demand has been sparse. Majority of Philippine demand studies examined vegetable as an aggregate commodity group (Regalado, 1985; Quisumbing et al., 1988; Llanto, 1998; San Juan, 1978; Orbeta and Alba, 1998). Only demand studies by Quisumbing (1985) and Belarmino (1983) used finer sub-categories (e.g. green, leafy, yellow, and fruit vegetables). There has been no study that investigated vegetable demand behavior at the vegetable commodity level. For example, price and income elasticities of particular vegetable commodities like tomato, cabbage, and eggplants (among others) have not been examined in the Philippines using a complete demand systems approach.

Given the importance of vegetables in the nutritional well-being of individuals, further understanding of vegetable demand behavior would provide valuable information to implement sound public health and dietary recommendations. This is especially important in a developing country like the Philippines where nutritional deficiencies among its population are prevalent because of widespread poverty (FNRI, 2004). Daily vegetable consumption in 2003 was 110 grams, which is well below the recommended daily allowance of 189 grams. The below average vegetable consumption is seen as one of the factors contributing to the inadequacy of energy and micronutrients in the Philippines (FNRI, 2004). Hence, information about vegetable demand behavior is essential in designing sound government-initiated nutritional programs to improve the status of malnourished households under the poverty line (Schneeman, 1997).

The objective of this study, therefore, is to examine vegetable food demand behavior of Philippine households at the commodity level. Particular emphasis is placed on calculating the price, income, and cross-price elasticities of commonly consumed Philippine vegetables. In addition, effects of socio-demographic factors and urban/rural dummy variables on vegetable food demand are also explored. This study makes a contribution in this regard because only a few studies incorporate socio-demographic factors into vegetable demand systems analysis (Raper, Wanzala and Nayga, 2002; Feng and Chern, 2000), and little have done so in a developing country context. Information on whether or not there is a differential vegetable demand behavior between urban and rural populations is essential in developing public nutritional programs and planning food supply policies.

The remainder of the paper is organized as follows. Theoretical issues related to the estimation procedures, as well as the estimation methods used, are discussed in the next section. Description of the household data and the results of the demand systems analysis are provided in the third section. The last section contains the conclusions and policy implications.

2. Theoretical Issues and Econometric Specification

2.1. Theoretical Issues

Figure 1 provides the utility trees of a representative household. Food consumption is assumed to be indirectly separable from non-food consumption and vegetable consumption is assumed to be indirectly separable from other food consumption. This procedure assumes that the consumer's utility maximization decision can be decomposed into three separate stages: in the first stage, total expenditure is allocated over food and non-food items. In the second stage, food expenditure is then allocated over vegetable and other food items. In the third stage, vegetable expenditures are allocated over the following vegetable commodities: cabbage, water spinach, horse radish tree leaves, Chinese white cabbage, bitter gourd, eggplant, okra, tomato, hyacinth bean, mungbeans, string beans and other vegetables. These vegetable commodities were chosen because they are the most commonly-used vegetables among all households in the Philippines and they account for 78% of total vegetable expenditures.

< INSERT FIGURE 1 HERE >

We motivate our estimation in the context of multi-stage budgeting. Let $q=[q_1,q_2,...q_n]$ denote the vector of goods demanded by the consumer and $p=[p_1,p_2,...p_n]$ be the corresponding vector of all prices. Further, let y be the total expenditure and $V(p)$ represent the indirect utility function, which is continuous, nonincreasing and quasicovex in p, homogenous of degree zero in (p,y). In general, by Roy's identity, a household solves the following indirect utility function:

(1) $$Max\ V(V_1(p_1), V_2(V_{21}(V_{211}(p_{211}, p_{212}, \ldots p_{21n}), V_{212}), V_{22}(p_{22}))\ .$$

Following Moschini (2001), the Marshallian unconditional demand functions $q_i(p)$ can be expressed in terms of the first-stage and second-stage expenditure allocation function ($y_2(p)$, $y_{2i}(p)$, and the third-stage conditional demand function $c_i(p_{21i})$, that is

(2) $$q_{21i}(p) = \frac{y_2(p)}{y} * \frac{y_{2i}(p)}{y_2(p)} * c_i(p_{21i}) = \frac{y_{2i}(p)}{y} * c_i(p_{21i})\ .$$

Equation (2) implies that the optimum within-group allocation is possible given only the group price p_{21i}, group expenditure allocation y_{2i}, and total expenditure y.

At the same time, since the price P_{21i} is unobservable, given expenditure y_{21i} and observable physical quantities q_{21i}, most of analysis used the unit value V_i as representative of the price P_{21i}, which is calculated as

(3) $$V_i = \frac{y_{21i}}{q_{21i}}\ .$$

However, as shown in Dong, Shonkwiler, and Capps (1998), V_i and y_{21i} are endogenously determined and can be expressed as:

(4) $$y_{21i} = f(V_i, y, W)\ ,$$

where W is a vector of household characteristics. Therefore, the estimation of the quantity demand system should be estimated simultaneously with the unit value system.

Moreover, since the total vegetable expenditure is endogenous with the share of vegetable expenditure, a total vegetable expenditure equation related to total expenditure is estimated based on a double-log relationship. The model to be estimated is as follows:

$$\log(y_{21}) = a_0 + \sum_k a_k s_{ki} + b \times \log(y) + \varepsilon_i \,, \tag{5}$$

where the s's are demographic and socioeconomic variables, the a's and b's are parameters to be estimated, and ε_i is the usual disturbance term.

To estimate the demand system (2) for the Philippine vegetables considered in this article, we adopt the Nonlinear Quadratic Almost Ideal Demand System (NQAIDS) developed by Banks, Blundell and Lewbel (1997). Existing literature points to several advantages of the NQAIDS over other flexible demand systems. In particular, these include nonlinearities and interactions with household-specific characteristics in the utility effects (which are important for household survey data) and better forecasting performance (Blundell, Pashardes, and Weber, 1993; Lyssiotou, Pashardes and Stengos, 2002). At the same time, this approach is amenable to including demographic variables, which is important for this type of analysis due to the individual household effects on vegetable consumption. The NQAIDS specification used in this study can be represented as follows:

$$w_{21i} = \alpha_i + \sum_j \gamma_{ij} \ln P_{21j} + \sum_i \alpha_{ij} Z_i + \beta_j (\ln y_{21} - \ln P) + \frac{\lambda_i}{\prod_j p_{21j}^{\beta_j}} \ln(\ln y_{21} - \ln P)^2 + \varepsilon_i \,, \tag{6}$$

where Z refer to demographic variables such as household size and educational achievement of household head, P is the corresponding price index, w_{21i} is the budget share of the *ith* vegetable,

ε_i is the error term, *α's, β's*, and *λ*'s are parameters to be estimated. The price index *P* is defined as:

(7) $$\ln P = \alpha_0 + \sum_j \alpha_j \ln P_{21j} + \frac{1}{2}\sum_j \sum_i \gamma_{ij} \ln P_{21i} \ln P_{21j} \; .$$

The symmetry, homogeneity and adding up constraints are imposed in the demand system estimated.

2.2. Estimation Procedure

To deal with the potential endogeneity problem between the unit value equation (4), total vegetable expenditure and the expenditure share equation (6), we adopt a three-step estimation procedure. First, we estimate the parameters of the system of equations associated with unit value equation (4) using seemingly unrelated regression (SUR). In the second step, an OLS equation is used to predict total vegetable expenditure (y_{21i}) based on total expenditure (y) (See equation (5)). The third step involves using SUR to estimate the demand system in (6), using the expected prices of the different vegetable commodities calculated in the first step and the total predicted vegetable expenditure computed in the second step.

2.3 Elasticity Calculation

Following Pofahl, Capps, and Clauson (2005), the uncompensated own-price, and cross-price elasticities associated with the NQAIDS are derived using the following expressions:

(8) $$\frac{\gamma_{ij}}{w_{21j}} - \left[\alpha + \sum_j \gamma_{ij} \ln p_j\right] + \left[\beta_i \frac{2\lambda_i}{b(p)}(\kappa)\right]\frac{1}{w_{21j}} - \delta_{ij}\,,$$ where:

(8a) $$b(p) = \prod_j p_{21j}^{\beta_j}\,,$$

(8b) $$\kappa = \ln y_{21j} - \alpha_0 - \sum_j \alpha_j \ln p_{21j} - \frac{1}{2}\sum_j \sum_i \gamma_{ij} \ln p_{21i} \ln p_{21j}\,,$$ and

(8c) $$\delta_{ij} = \begin{cases} 0 & if\ i = j \\ 1 & otherwise \end{cases}.$$

Expenditure elasticities are computed as:

(9) $$\varepsilon_i = 1 + \frac{\beta_i}{w_{21i}} + \frac{2\lambda_i}{w_{21i} b(p)} \log\left(\frac{y_{21}}{P}\right)$$

Based on Slusky's equation, the compensated price elasticities are derived:

(10) $$e_{ij}^* = e_{ij}^U + e_i^* w_{21j}$$

where e_{ij}^* is the compensated price elasticity that corresponds to goods i and j, e_{ij}^U is the uncompensated price elasticity of the same goods, and e_i^* is the total expenditure elasticity of good i.

3. Data and Empirical Results

3.1 Data

The data set used for the analysis is the 2003 Family Income and Expenditures Survey (FIES) for the Philippines. These surveys were conducted every three years beginning in 1985 and the most recent of which was done in 2003. Note that only the 2003 data were made available to us. The data set contains information on quantities and expenditures of over 50 food items. As suggested in equation (3), the unit value or price is obtained from the ratio of its associated expenditure to its associated quantity. For our purposes, we extracted the whole vegetable section from the survey, which includes information for 39,264 households. Of these households, 23,234 (59%) are classified as urban households and 16,030 (41%) are rural households. The classification of households into urban or rural is based on the guidelines of the Philippine Census of Population and Housing, where factors such as population density and number of commercial establishments (among others) are considered.

As mentioned above, the following Philippine vegetable commodities were considered in this study: cabbage, water spinach, horseradish tree leaves, Chinese white cabbage, bitter gourd, eggplant, okra, tomato, hyacinth bean, mungbeans, string beans, and other vegetables. The total food expenditures and the relevant quantities for each of the vegetables considered were also extracted. Other demographic information for each household was also included in the data used for estimation (i.e. household income, classification of urbanity, household size, age, employment status, and presence of children).

The FIES survey adopts the "shuttle type" of data collection wherein respondents are interviewed on two occasions using the same questionnaire. The 1st interview is usually done in July of the reference year to gather data for the first 6 months of the year (January-June). The 2nd interview is done in January of the following year, to account for the last 6 months (July – December). The scheme is done to minimize memory bias and to capture the seasonality of income and expenditure patterns. Annual data is estimated by combining the results of the 1st and the 2nd visit. The concept of "average week" consumption for all food items was utilized.

Just as a rough snapshot of the data, Table 1 provides a comparison of the mean vegetable commodity expenditures between rural and urban households. Based on the average vegetable expenditures, one may conclude that there is a significant difference between rural and urban consumption behavior because expenditures in the urban areas tend to be twice as much as in the rural areas. However, consumption behavior cannot be inferred simply from these mean comparisons. A complete demand systems approach, which controls for a number of other factors, would provide more credible information about the vegetable consumption behavior of rural and urban households in the Philippines.

< INSERT TABLE 1 HERE >

3.2. Empirical Results

Using the three-step procedure described above, we first estimate the relevant demand parameters of the demand system and then calculate the relevant elasticities of interest. However, in the interest of space and in light of the large number of parameters estimated, the estimation results are not presented here but are available from the authors upon request.

< INSERT TABLE 2 HERE >

The expenditure elasticities for each of the Philippine vegetable commodities considered are presented in Table 2. All expenditure elasticities are statistically significant at the 5% level. In general, our estimated expenditure elasticities for the different vegetable commodities are close to unitary values, which is consistent with previous studies (Quisumbing 1985; Belarmino 1983; Regalado 1985; Llanto 1998; Alba 1998). For both urban and rural areas, the commodities of note are cabbage, bitter gourd, and hyacinth bean, which tend to have high expenditure elasticities relative to the other vegetables. Larger expenditure elasticities for these three commodities indicate that increasing income would induce more consumption of these commodities relative to the other vegetables. This is especially true for cabbage which is typically viewed as a luxury vegetable commodity in the Philippines since this vegetable crop is typically commercially grown only in a handful of areas where the temperatures are low all year round. This condition is atypical in a tropical country like the Philippines. At the other end of the spectrum, tomato is another commodity of note since it tends to have lower expenditure elasticity relative to the other vegetables (especially in the urban areas). This indicates that this vegetable is viewed more as a necessity. Tomato as a necessity is not surprising as most simple diets or viands in most areas in the Philippines use it as an ingredient to sauté fish, meat and other vegetables (together with onions and garlic). Of the twelve vegetable commodities considered, only cabbage and Chinese white cabbage have urban expenditure elasticities that are significantly different from rural expenditure elasticities. Therefore, public policies that affect income levels do not have a differential effect on vegetable consumption behavior in the rural areas versus the urban areas (except for cabbage and Chinese white cabbage).

In Tables 3 and 4, estimates of compensated own- and cross-price elasticities for rural and urban households are shown. The own-price elasticities are the values in the diagonal of the tables. In the interest of conciseness the uncompensated elasticity estimates are not reported, but are available from the authors upon request. Note that the results for the compensated and uncompensated are very similar and the major behavioral patterns observed are the same.

< INSERT TABLES 3 AND 4 HERE >

The compensated own-price elasticities are statistically significant in both rural and urban areas and carry the expected negative sign (Table 3). Our estimates also show that most rural own-price elasticities are about unitary elastic, with the exception of hyacinth bean and mungbeans whose demand are more elastic than the other vegetables (at -1.35 and -1.60, respectively). The own-price elasticities of most vegetable commodities are larger in magnitude for urban households relative to their rural counterparts (Table 4). More vegetables are own-price elastic in the urban areas (relative to the urban areas): cabbage (-1.209), water spinach (-1.197), hyacinth bean (-1.120), and mungbeans (-1.307). Also, note that the own-price elasticities of most vegetables in the urban areas are not significantly different from the rural own-price elasticity estimates (except for cabbage). This shows that vegetable consumption response to price changes tend to be the same in the rural and urban areas. This is important information for evaluating and implementing public policies that affect vegetable prices.

Tables 3 and 4 also shows there are a number of statistically significant cross-price elasticities for the vegetables considered in the study. Positive cross-price elasticities indicate substitutability, while negative cross-price elasticities indicate complementarity. Since it is cumbersome to discuss the complementarity or substitutability of each possible pair of vegetable commodity, we only discuss the general behavioral patterns observed from the cross-price elasticity results. First, similar vegetable commodities that typically fall into the same vegetable category tend to be substitutes. For example, most of the leafy vegetables (e.g. cabbage, water spinach, horseradish tree leaves, and pechay) tend to be substitutes with the other leafy vegetables. The "fruit" vegetables (e.g. bitter gourd, eggplant, okra, tomato, and hyacinth bean) tend to be substitutes with other "fruit" vegetables. Second, across the broad vegetable groupings, the particular vegetable commodities tend to be complements. For example, leafy vegetables (i.e. cabbage) tend to be complements with tomato (i.e. fruit vegetables). The complementarity observed across broad vegetable categories may be due to the nature of how vegetables are cooked in the Philippines. That is, most of them are sautéed in oil or cooked together with some mixture of sauce, seasoning, or soup base. The usual Philippine dishes with vegetables always combine leafy and fruit vegetables, which supports the complementarity across broad vegetable categories.

About a fifth of the own- and cross-price elasticity estimates are significantly different between rural and urban households. These are indicated by asterisks in Table 4. In terms of compensated own-price elasticities, only the price elasticity of cabbage differ in the urban areas relative to the rural areas. In terms of the compensated cross-price elasticities, the differential behavior of urban households (relative to rural households) are only observed in the degree of responsiveness of most vegetable items to changes in cabbage, tomato, and hyacinth bean prices.

These results suggest that, on balance, the own-price and cross-price demand behavior of urban households do not significantly differ from rural households.

Our results are consistent with Llanto (1998) in that for fruits and vegetables taken as a group: (i) the dummy for urban areas proved insignificant; and (ii) demand was approximately unitary price elastic for all households. On the other hand, our estimates are typically higher than previous studies of vegetable demand (Quisumbing (1985); Belarmino (1983)), with own-price elasticities for green, leafy and yellow vegetables that hover around -0.4 and -0.8. But note that these studies use data that are about fifteen years prior to the one we use here. The magnitude of demand responsiveness of Philippine consumers may have changed over time.

Tables 5 and 6 present the effect of a number of demographic variables on vegetable demand for rural and urban households, respectively. In rural areas, marital status of the household head significantly affects cabbage, water spinach, eggplant, and hyacinth bean consumption. Age of the household head affects tomato and string beans consumption in the rural areas. Gender of household head also affects cabbage, eggplant, tomato and string beans demand in the rural areas. Lastly, the variables of family structure and employment status of household head also significantly affect some of vegetable consumption in the rural areas. On the other hand, marital status of the household head and gender does not have any significant effect on any of the vegetable consumption in urban households. Comparing the demand impacts of the various demographic variables in the rural and urban areas, only the effects of gender, employment status of household head, and family structure variables tend to be significantly different in the urban areas relative to the rural areas. On balance, for the majority of the vegetable crops, there seems to be no significant difference between rural and urban households in terms of the impact of changes in demographic variables on vegetable demand.

< INSERT TABLES 5 AND 6 HERE >

4. Conclusion and Policy Implications

This article compares vegetable demand behavior between rural and urban households in the Philippines. A three-step methodology is used to solve endogeneity among the unit value, total vegetable expenditure, and the expenditure share of different vegetables. An NQAIDS approach is used to estimate the vegetable demand system primarily due to its flexibility and accuracy (relative to other approaches in the literature).

For majority of the vegetable commodities examined, the expenditure, own-price, and cross-price elasticities of urban households do not significantly differ from those of rural households. The responsiveness of demand to demographic factors also typically do not differ between rural and urban households. These results are indicative of a common vegetable demand function for rural and urban households, at least for majority of the vegetable commodities. However, note that there are still some vegetable commodities where demand behavior in the urban areas significantly differs from the rural areas (i.e. cabbage).

The results from this study points to several policy implications. First, the general observation that vegetable demand behavior tend to be the same for urban and rural households indicates the possibility of simplified implementation of policies aimed to address nutritional deficiencies in the Philippines. Instead of differential policy approaches in rural and urban areas, an integrated approach may be more feasible. Second, the elasticity information generated from this article would be useful for simulation and further analysis of various nutritional programs, income stabilization policies, and food supply programs. In turn, these types of analyses would enable quantification of the welfare effects of different policies and, consequently, aid in the planning, design, and implementation of various government programs (i.e. agricultural price stabilization schemes and poverty alleviation programs). Lastly, the elasticities calculated for the different vegetable commodities can also be used to improve vegetable consumption forecasting in the Philippines, an area in which empirical studies are nascent. Furthermore, the elasticities in this study would be helpful in forecasting at the vegetable commodity level rather than at the more aggregate levels. Information from these commodity level forecasts would be more useful to policymakers and analysts.

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Figure 1. Utility Tree of Vegetable Consumption in Philippines

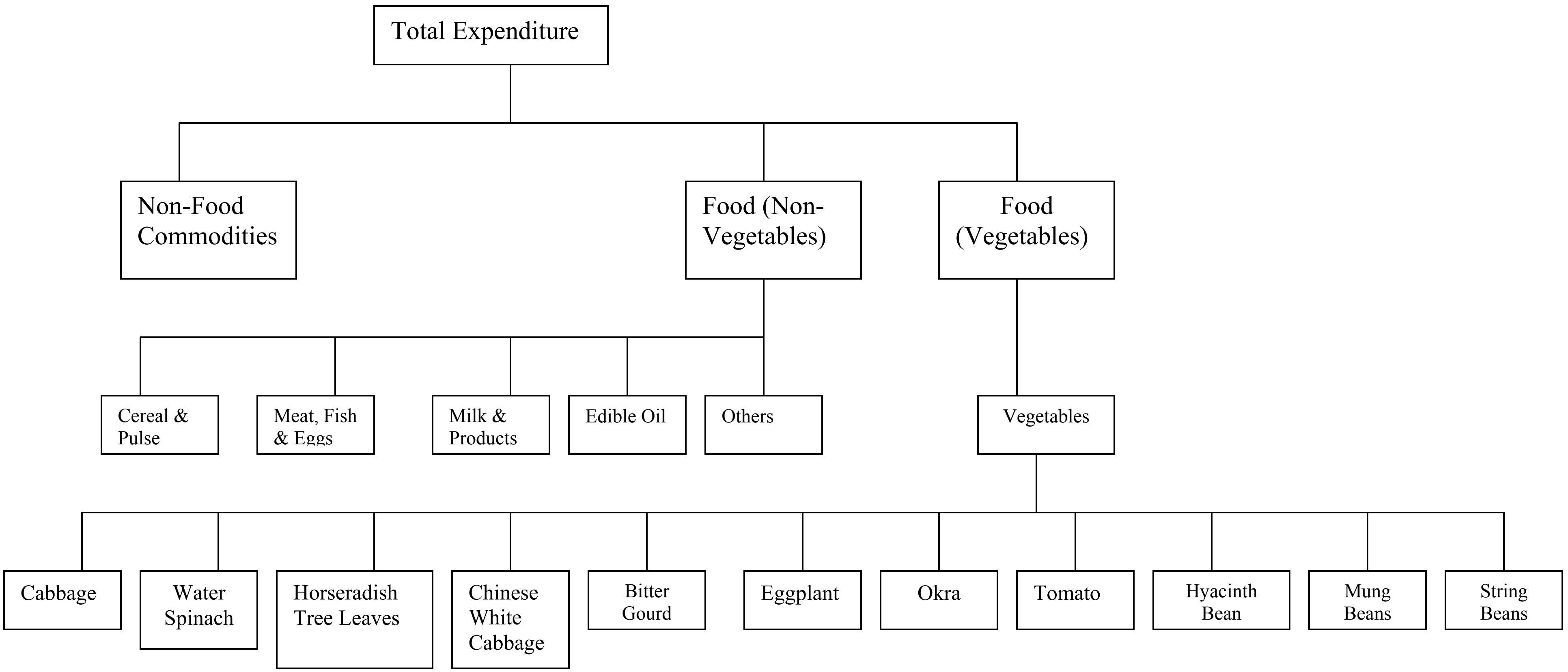

Table 1. Mean Expenditures: Rural and Urban

	Rural	Urban
Total expenditure	72610.560	145008.020*
	(148.952)	(144.713)
Total food expenditure	37693.340	60282.320*
	(223.287)	(239.718)
Total vegetable expenditure	1971.230	2680.650*
	(167.660)	(206.872)
Expenditure shares		
Cabbage	0.045	0.094*
	(73.080)	(141.778)
Water Spinach	0.138	0.104*
	(143.824)	(164.214)
Horseradish Tree Leaves	0.101	0.059*
	(108.167)	(103.757)
Chinese White Cabbage	0.052	0.075*
	(82.317)	(145.483)
Bitter Gourd	0.079	0.090*
	(108.169)	(150.198)
Eggplant	0.124	0.124
	(143.881)	(189.141)
Okra	0.050	0.051
	(101.029)	(133.296)
Tomato	0.132	0.157*
	(152.279)	(213.548)
Hyacinth Bean	0.020	0.034*
	(43.901)	(84.086)
Mungbeans	0.078	0.070*
	(95.199)	(120.724)
String Beans	0.100	0.091*
	(129.850)	(156.232)
Others	0.081	0.052*
	(32.202)	(8.508)

t-values in parenthesis;
* represent significant difference between rural and urban.

Table 2. Expenditure Elasticities

Commodity	Rural	Urban
Cabbage	1.246	1.362*
	(88.399)	(39.472)
Water Spinach	0.889	0.903
	(29.302)	(25.857)
Horseradish Tree Leaves	0.979	0.912
	(17.725)	(13.804)
Chinese White Cabbage	0.859	1.007*
	(28.991)	(23.512)
Bitter Gourd	1.135	1.181
	(57.422)	(34.649)
Eggplant	0.988	0.936
	(43.928)	(27.009)
Okra	0.920	1.024
	(40.608)	(32.294)
Tomato	0.936	0.791
	(48.496)	(28.285)
Hyacinth Bean	1.665	1.549
	(39.635)	(25.562)
Mung Beans	0.901	0.838
	(40.266)	(19.620)
String Beans	0.945	0.953
	(34.032)	(30.088)
Others	0.863	1.372
	(10.672)	(11.234)

t-values are in the parenthesis

Table 3. Compensated Own- and Cross-Price Elasticities: Rural Areas

	Cabbage	Water Spinach	Horseradish Tree Leaves	Chinese White Cabbage	Bitter Gourd	Eggplant	Okra	Tomato	Hyacinth Bean	Mung-beans	String bean	Others
Cabbage	-0.989	0.048	0.161	-0.086	-0.067	0.009	0.007	-0.023	-0.073	-0.160	-0.019	0.149
	(-47.569)	(2.625)	(6.191)	(-4.707)	(-0.891)	(0.623)	(0.271)	(-3.658)	(-9.576)	(-1.470)	(-0.949)	(4.073)
Water Spinach	0.016	-1.071	-0.136	0.078	0.060	-0.013	0.071	0.015	-0.020	0.179	-0.024	-0.130
	(0.781)	(-7.163)	(-0.754)	(2.717)	(0.303)	(-0.380)	(0.682)	(2.188)	(-0.489)	(0.598)	(-0.384)	(-0.502)
Horseradish Tree Leaves	0.085	-0.071	-0.994	0.050	-0.032	-0.041	0.016	0.025	0.133	0.307	-0.026	-0.574
	(5.012)	(-4.019)	(-5.452)	(2.145)	(-0.199)	(-1.481)	(0.189)	(4.236)	(3.124)	(1.289)	(-0.509)	(-2.989)
Chinese White Cabbage	-0.098	0.054	0.055	-1.037	-0.060	-0.028	-0.012	-0.010	-0.036	0.010	0.009	0.141
	(-6.605)	(2.592)	(1.880)	(-28.349)	(-0.744)	(-1.786)	(-0.448)	(-1.875)	(-2.646)	(0.127)	(0.402)	(3.354)
Bitter Gourd	-0.010	0.028	0.000	-0.003	-0.969	0.009	0.090	-0.008	0.149	0.006	0.026	-0.137
	(-0.543)	(0.635)	(0.003)	(-0.129)	(-16.267)	(0.348)	(1.594)	(-1.249)	(11.046)	(0.036)	(0.609)	(-1.478)
Eggplant	-0.020	-0.003	-0.085	-0.031	-0.009	-0.938	-0.009	-0.002	0.085	-0.008	0.003	0.030
	(-0.999)	(-0.081)	(-1.482)	(-1.181)	(-0.060)	(-26.053)	(-0.180)	(-0.252)	(10.026)	(-0.055)	(0.066)	(0.357)
Okra	-0.013	0.036	0.011	-0.005	0.164	-0.006	-0.992	0.003	0.153	-0.004	-0.024	-0.071
	(-0.995)	(0.713)	(0.149)	(-0.281)	(1.345)	(-0.290)	(-12.249)	(0.754)	(5.766)	(-0.027)	(-0.905)	(-0.653)
Tomato	-0.077	0.041	0.071	0.001	-0.138	0.000	0.023	-1.021	-0.025	0.003	0.012	0.019
	(-7.304)	(4.102)	(7.120)	(0.095)	(-3.183)	(-0.043)	(1.714)	(-119.661)	(-0.954)	(0.124)	(1.360)	(1.023)
Hyacinth Bean	-0.035	-0.003	0.115	0.002	-0.237	0.007	-0.012	0.002	-1.354	-0.044	0.031	0.199
	(-2.713)	(-0.085)	(2.414)	(0.128)	(-2.206)	(0.356)	(-0.283)	(0.337)	(-2.287)	(-0.381)	(1.001)	(2.810)
Mungbeans	-0.017	0.128	0.366	0.019	-0.020	-0.004	0.000	0.005	-0.231	-1.602	0.019	0.149
	(-0.910)	(1.742)	(3.519)	(0.711)	(-0.116)	(-0.121)	(-0.005)	(0.814)	(-8.390)	(-4.006)	(0.359)	(4.073)
String bean	-0.040	-0.011	-0.038	0.023	0.056	0.003	-0.040	0.006	0.072	0.024	-0.948	0.149
	(-2.122)	(-0.201)	(-0.486)	(0.890)	(0.329)	(0.102)	(-0.595)	(0.959)	(3.553)	(0.132)	(-15.463)	(1.003)
Others	0.070	-0.059	-0.507	0.105	-0.333	0.013	-0.069	0.012	0.170	-1.515	-0.034	-0.579
	(1.539)	(-0.457)	(-2.977)	(3.478)	(-1.609)	(0.369)	(-0.614)	(1.545)	(2.841)	(-2.818)	(-0.515)	(-0.298)

Note: t-values are in the parenthesis;
*significantly different from rural estimates based on computed t-test.

Table 4. Compensated Own- and Cross-Price Elasticities: Urban Areas

	Cabbage	Water Spinach	Horseradish Tree Leaves	Chinese White Cabbage	Bitter Gourd	Eggplant	Okra	Tomato	Hyacinth Bean	Mung-beans	String bean	Others
Cabbage	-1.209*	0.255*	0.248*	-0.043	-0.057	0.085*	0.005	-0.011	-0.214*	-0.121	0.007	0.328*
	(-23.207)	(10.830)	(7.844)	(-1.162)	(-1.246)	(6.679)	(0.134)	(-1.476)	(-12.873)	(-1.367)	(0.285)	(6.470)
Water Spinach	0.549*	-1.197	0.123	0.200	-0.099	0.030	0.131	0.160*	0.261*	0.201	0.028	-0.029
	(7.703)	(-8.319)	(0.821)	(2.675)	(-1.168)	(1.537)	(0.780)	(13.538)	(5.203)	(0.771)	(0.485)	(-0.113)
Horseradish tree leaves	0.508*	0.139*	-1.027	0.182	-0.021	0.000	-0.092	0.139*	0.466*	0.203	-0.047	-0.162
	(7.148)	(12.185)	(-5.159)	(2.444)	(-0.245)	(-0.004)	(-0.531)	(11.801)	(9.084)	(0.765)	(-0.805)	(-0.674)
Chinese White cabbage	-0.023	0.155*	0.112	-0.943	-0.072	0.061*	0.131*	0.015*	0.181*	-0.068	0.046	0.214
	(-0.541)	(5.417)	92.928)	(-15.889)	(-1.319)	(4.444)	(2.616)	(1.757)	(9.575)	(-0.647)	(1.585)	(3.506)
Bitter Gourd	0.048	0.081	0.063	0.007	-0.924	0.096*	0.166	-0.007	0.495*	0.042	0.019	0.109*
	(1.053)	(2.908)	(1.685)	(0.142)	(-22.797)	(6.547)	(3.466)	(-0.779)	(26.489)	(0.403)	(0.636)	(1.846)
Eggplant	0.094*	0.074*	-0.013	0.018	0.013	-0.878	0.212*	0.020	0.387*	0.049	0.074	0.087
	(2.762)	(4.162)	(-0.577)	(0.562)	(0.319)	(-45.160)	(7.134)	(2.105)	(27.842)	(0.697)	(3.580)	(2.367)
Okra	-0.022	0.108	-0.040	0.078	0.053	0.118*	-0.939	0.045*	0.500*	0.016	0.074*	0.126
	(-0.480)	(1.758)	(-0.463)	(1.629)	(0.981)	(9.587)	(-6.493)	(6.446)	(15.210)	(0.088)	(1.730)	(0.888)
Tomato	-0.067	0.233*	0.213*	0.001	-0.169	0.056*	0.133*	-1.017	0.200*	0.010	0.047	0.040
	(-3.028)	(20.013)	(15.277)	(0.057)	(-6.417)	(5.433)	(7.230)	(-90.958)	(6.086)	(0.396)	(0.506)	(2.256)
Hyacinth bean	-0.084	0.100*	0.103	0.050	0.132*	0.107*	0.229*	0.033*	-1.120	-0.079	0.064	0.167
	(-2.096)	(2.122)	(1.566)	(1.207)	(2.791)	(9.485)	(2.770)	(5.093)	(-1.643)	(-0.580)	(2.023)	(1.444)
Mungbeans	-0.146	0.210	0.212	-0.065	0.029	0.098*	0.114	-0.031*	-0.147*	-1.307	0.079	0.328*
	(-2.346)	(3.506)	(2.564)	(-1.015)	(0.395)	(5.323)	(1.525)	(-2.772)	(-4.314)	(-3.192)	(1.497)	(6.470)
String beans	0.037	0.109*	-0.001	0.093	-0.048	0.112*	0.206*	0.006	0.365*	0.081	-0.970	0.328
	(0.670)	(2.573)	(-0.011)	(1.682)	(-0.726)	(6.657)	(2.772)	(0.582)	(14.032)	(0.485)	(-17.400)	(1.413)
Others	0.519*	0.035	-0.133	0.253	0.017	0.074	0.171	0.145*	0.529*	-1.363	0.032	0.172
	(5.731)	(0.231)	(-0.692)	(2.682)	(0.156)	(3.061)	(0.748)	(9.684)	(7.379)	(-1.536)	(0.436)	(0.066)

Note: t-values are in the parenthesis;
*significantly different from rural estimates based on computed t-test

Table 5. Effects of Demographic Variables on Vegetable Consumption: Rural Areas

	Cabbage	Water Spinach	Horseradish Tree Leaves	Chinese White Cabbage	Bitter Gourd	Eggplant	Okra	Tomato	Hyacinth Bean	Mung-beans	String Beans	Others
Male/Female	0.0043	0.002	0.001	0.001	-0.0004	-0.009	-0.0002	0.009	0.0023	-0.004	-0.005	0.0001
	(2.210)	(0.560)	(0.261)	(0.281)	(0.223)	(4.019)	(0.130)	(4.138)	(1.719)	(1.961)	(2.315)	(0.012)
Age of household head	0.0001	-0.0001	-0.0001	0.0001	0.0001	-0.0001	0.0001	-0.0002	0.0001	0.0000	-0.0002	-0.0001
	(1.586)	(1.474)	(0.921)	(1.102)	(0.182)	(0.882)	(1.720)	(3.492)	(1.432)	(0.447)	(2.174)	(0.232)
Marriage status of household head	-0.0045	0.005	-0.001	-0.002	-0.001	0.005	-0.001	0.0001	-0.003	0.003	0.001	-0.002
	(2.941)	(2.068)	(0.365)	(1.352)	(0.614)	(2.670)	(0.631)	(0.051)	(2.549)	(1.557)	(0.645)	(0.312)
# of kids under 6	-0.0007	0.0020	0.005	-0.001	-0.001	0.0003	-0.0003	-0.004	0.0002	0.006	-0.004	-0.003
	(0.132)	(0.689)	(2.080)	(0.586)	(0.536)	(0.150)	(0.179)	(1.651)	(0.138)	(2.604)	(1.730)	(0.453)
# of Kids between 6-13	-0.0024	0.003	0.002	-0.0004	-0.003	-0.001	-0.001	-0.003	-0.001	0.004	0.002	0.0005
	(3.144)	(2.732)	(2.258)	(0.547)	(3.197)	(1.684)	(1.121)	(3.747)	(1.782)	(5.036)	(2.442)	(0.176)
# of kids between 13-18	-0.0024	-0.002	0.002	0.000	-0.001	0.0004	-0.0002	-0.003	-0.001	0.004	0.001	-0.0004
	(3.997)	(2.390)	(2.637)	(0.081)	(1.139)	(0.614)	(0.481)	(5.182)	(1.264)	(5.064)	(0.717)	(0.181)
# of adults	-0.0031	0.002	0.002	0.000	-0.002	0.001	-0.001	-0.0004	-0.001	0.002	0.0002	0.0003
	(5.403)	(2.300)	(3.730)	(0.064)	(2.887)	(0.912)	(2.386)	(0.622)	(2.302)	(3.286)	(0.351)	(0.151)
Employment status of household head	-0.0034	0.003	0.005	-0.003	0.0002	-0.0002	0.001	0.0001	-0.004	0.002	-0.0004	-0.001
	(4.579)	(2.162)	(6.026)	(4.019)	(0.206)	(0.227)	(1.269)	(0.131)	(6.920)	(1.967)	(0.492)	(0.169)

t-values are in the parenthesis

Table 6. Effects of Demographic Variables on Vegetable Consumption: Urban Areas

	Cabbage	Water Spinach	Horseradish Tree Leaves	Chinese White Cabbage	Bitter Gourd	Eggplant	Okra	Tomato	Hyacinth Bean	Mung-beans	String Beans	Others
Male/female	0.003	-0.001	-0.004	0.001	0.006*	-0.010	-0.003	-0.001*	0.002	0.001	-0.001	0.005
	(1.323)	(0.157)	(0.779)	(0.452)	(2.224)	(3.081)	(0.914)	(0.327)	(0.885)	(0.362)	(0.187)	(0.437)
Age of household head	0.0001	-0.0002	0.0001	-0.0001	0.0001	-0.0002	0.000	-0.0002	0.0001	0.0002	-0.0001	0.0001
	(2.482)	(1.717)	(0.887)	(1.356)	(0.465)	(2.763)	(0.702)	(2.000)	(1.653)	(2.488)	(1.579)	(0.434)
Marriage of household head	-0.0006	0.001	-0.005	-0.001	-0.003	0.009	0.002	0.002	-0.002	0.001	0.002	-0.006
	(0.355)	(0.321)	(1.533)	(0.641)	(1.245)	(3.713)	(1.301)	(0.624)	(0.968)	(0.502)	(0.705)	(0.704)
# of kids under 6	0.005	0.001	0.004	0.001	0.001	-0.013*	-0.004	-0.002	-0.001	0.007	-0.001	0.002
	(0.665)	(0.303)	(1.096)	(0.458)	(0.296)	(4.558)	(2.158)	(0.533)	(0.316)	(2.238)	(0.453)	(0.183)
# of kids between 6-13	0.001*	-0.0003	-0.001	0.001	-0.002	-0.003	-0.001	-0.001*	-0.001	0.002	0.001	0.002
	(1.328)	(0.152)	(0.260)	(1.491)	(1.981)	(2.433)	(0.854)	(0.490)	(0.569)	(1.467)	(0.680)	(0.526)
# of kids between 13-18	-0.001	-0.001	0.002	-0.001	-0.002	-0.002	-0.0004	-0.002	0.0002	0.0002*	0.000	0.003
	(2.548)	(1.108)	(1.519)	(1.053)	(2.719)	(2.068)	(0.723)	(2.812)	(0.478)	(0.301)	(0.045)	(1.333)
# of adults	-0.003	0.0009	0.0002	0.0003	-0.002	0.002	0.001	0.002*	-0.001	-0.001*	0.001	-0.001
	(4.090)	(0.399)	(0.107)	(0.346)	(2.194)	(2.054)	(0.469)	(2.631)	(0.599)	(0.585)	(0.970)	(0.262)
Employment status of household head	-0.002	0.003	0.004	-0.006	-0.002	-0.001	-0.001	-0.004*	-0.001*	0.006	-0.002	0.005
	(2.311)	(1.372)	(1.604)	(6.472)*	(1.485)	(1.189)	(0.669)	(4.139)	(0.907)	(3.512)	(0.455)	(1.102)

t-values are in the parenthesis

*statistically different from rural estimates based on t-test