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ESTIMATION OF FOOD DEMAND FROM HOUSEHOLD SURVEY DATA IN VIETNAM

Linh Vu Hoang[1]

Abstract

This paper analyzes food consumption patterns of Vietnamese households, using a complete demand system and socio-demographic information. Demand elasticities are estimated using the AIDS model and the latest Vietnamese household survey data in 2006. The results indicate that food consumption pattern in Vietnam are affected by income, price as well as socio-economic and geographic factors. All food has positive expenditure elasticities and negative own-price elasticities. In particular, rice has mean expenditure elasticity of 0.36 and mean own-price elasticity of -0.80. Thus, an increase in the price in rice by one percent will reduce rice consumption by 0.8 percent, on average. On the other hand, an increase in the income by 1 percent leads to an increase in rice demand by 0.36 percent. It indicates that food consumption in urban and rural areas, and among regions and income groups are different. It points out that targeted food policies should be formulated based on specific food demand patterns in the groups.

Keywords: Vietnam, food consumption, food demand, AIDS, elasticity.

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1. Introduction

Household food consumption has long been an important area of research for economists. Studies on food consumption help to provide a better understanding of how the demand for food responds to changes in food prices as well as changes in household income. This information is essential for evaluating the welfare effects of many types of economic shocks as well as the welfare impacts from trade liberalization. Demand analysis can be based on either aggregated time-series data or household surveys. However, in many developing countries the availability of reliable time-series data on aggregate demand, prices and income is limited. In contrast, many household surveys implemented in these countries provide rich and fairly reliable micro data on household consumption patterns. Food demand analysis based on household surveys has been increasingly used in recent years. In developing countries, where a large percentage of household expenditure is allocated to food, consumer expenditure surveys are particularly useful because they can provide information on specific subpopulation of households that are more likely to be affected by changes in commodity prices or household incomes.

Several papers have been written on household food demand in Vietnam, particularly rice demand, most of which are unpublished. Haughton et al (2004) used data from the 1998 Vietnam Living Standard Survey (VLSS 1998) to estimate the price and expenditure elasticities of rice, using a double-log specification. The mean own-price elasticity of rice is estimated to be -0.42, while the mean expenditure elasticity of rice is 0.09. Benjamin and Brandt (2004) used panel data from the 1993 and 1998 Vietnam Living Standard Survey to estimate Engel curves for Vietnam. The expenditure elasticity of rice is estimated to be 0.49 and 0.41 for the urban north and the urban south, respectively, and 0.64 and 0.63 for the rural north and rural south. As part of a comprehensive study on rice market liberalization in Vietnam, Minot and Goletti (2000) used the Almost Ideal Demand System (AIDS) functional form to estimate household food demand in Vietnam in 1998. Their expenditure elasticities of rice were 0.48 for the North and 0.11 for the South, while the estimated own-price elasticities were -0.2 in the North and -0.38 in the South. Finally, Niimi (2005) examined the robustness of Deaton's method to correct the bias from using unit values as proxies for missing market prices (Deaton 1990), using the 1993 and 1998 VLSS data.

This paper contributes to the analysis of food demand by applying a method based on Cox & Wohlgenant (1986) to correct for the bias from using unit values as proxies for prices. Using household expenditure data and a linear approximation of the Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980), I estimate food demand parameters in Vietnam. The AIDS model is the most popular method in demand analysis, which allows for comparisons with other studies.

The structure of the rest of this paper is organized as follows. Section 2 presents the model and estimation. Section 3 describes the data and summarizes food consumption patterns in Vietnam. Section 4 presents the estimation results. The last section provides concluding remarks.

2. Model and Estimation

The Almost Ideal Demand System (AIDS) is the most common functional form used to estimate systems of demand. In practice, a linear approximation of the Almost Ideal Demand System (LA/AIDS) is often employed. This paper assumes weak seperability of demand, thus ignoring non-food commodities in the estimation. The model takes the following form:

$$w_i = \alpha_i + \beta_i \ln\left(\frac{\mathrm{x}}{\mathrm{P_c}}\right) + \sum_{j=1} \theta_{ij} \ln(p_j) + \sum_{m=1} \gamma_{im} Z_{im} + u_i \quad (1)$$

where w_i is the budget share of food item i, p_j is the j^{th} food item, Z_{im} is a set of household characteristics, x is the value of food consumption expenditure per person, and P_c is a unit value index defined by

$$ln\ P_c = \delta_0 + \sum_j \delta_j \ln p_j + \frac{1}{2} \sum_j \sum_k \theta_{jk} \ln p_j\ ln\ p_k \quad (2)$$

The presence of Z vector implies that the differences in tastes for foods are mainly determined by those household characteristics.

In practice, to avoid nonlinearity, $ln\ P_c$ can be approximated by the logarithm of the Stone's price index.

$$ln\ P_c = \sum_j \overline{w}_j \ln p_j \quad (3)$$

In this equation, $\overline{w}_j$ represents the mean budget share of food item j.

The following set of restrictions are derived from economic theory and imposed upon the parameters in the LA/AIDS model to make the model consistent with the theory of demand.

Adding-up restrictions:

$$\sum_i \alpha_i = 1;\ \sum_i \beta_i = 0;\ \sum_i \theta_{ij} = 0;\ \sum_i \gamma_{im} = 0; \tag{4}$$

Homogeneity restriction:

$$\sum_j \theta_{ij} = 0 \tag{5}$$

Symmetry restriction:

$$\theta_{ij} = \theta_{ji} \tag{6}$$

By differentiating equations (1) and (2) with respect to prices and expenditure, one obtains the following elasticity measures:

Marshallian owned-price elasticity of food item *i*:

$$\epsilon_{ii} = (\theta_{ii} - \beta_i w_i)/w_i - 1 \tag{7}$$

Marshallian cross-price elasticity of food item *i* with respect to the price of food item *j*:

$$\epsilon_{ij} = (\theta_{ij} - \beta_i w_j)/w_i \ \ \forall\ i \neq j \tag{8}$$

Expenditure elasticity of food item *i*:

$$\eta_i = \beta_i/w_i\ + 1 \tag{9}$$

The Hicksian price elasticity is estimated from the Slutsky equation:

$$\epsilon_{ij}^h = \epsilon_{ij}\ + \eta_i w_j\ \forall\ i,j \tag{10}$$

One problem with using household expenditure surveys for estimating household demand is that many household surveys do not collect price data. A common practice has been to calculate unit values dividing expenditures by corresponding quantities and use them as a direct substitute for market prices (Deaton 1988). However, it has been argued (Deaton 1990, Cox& Wohlgenant 1986, Huang and Lin 2000) that there are some problems with treating unit values as market prices. First, such a calculated unit value may reflect not only differences in prices, but also differences in the qualities of the goods that households purchase. The quality effects implicit in unit values may be influenced by prices and income as consumers respond to changes

in price and income by altering both the quantity and the quality of the goods they purchase. Second, because unit values are calculated by dividing expenditures by quantities, the approach suffers from measurement errors in both the quantity and the expenditure data.

Several methods have been applied to overcome the quality and measurement errors problems. Deaton (1990) developed a procedure to correct the price elasticities. He assumed that households within the same geographical cluster face the same market prices, thus, within-cluster variation in unit values and expenditures is used to estimate the effects of household income and characteristics on quantities and qualities of purchased goods, as well as to separate measurement errors from price data. Based on corrected quantities and unit value, it is then possible to estimate the "corrected" demand system, removing the impacts of both quality effects and measurement errors. The method is widely applied in literature, for example in Nicita (2004), Niimi (2005), and Friedman and Levinsohn (2002). The disadvantage of Deaton's method is that the covariance of residuals, which is used to estimate corrected price elasticities, can be influenced by many unexplained factors, not just price variation. Deaton's approach is also hard to implement, using complicated matrix multiplication.

Cox and Wohlgenant (1986) proposed another approach. They assumed that the deviations of unit values from regional or seasonal means reflect quality effects. They regressed the mean-deviated unit values on household characteristics to exclude the quality effects from unit values and obtain quality-adjusted prices. These quality-adjusted prices are then used in their household demand system estimation. Cox and Wohlgenant's approach is used in several papers such as Park et al. (1996), Gao et al. (1994), Lazaridis (2004). An important advantage of Cox and Wohlgenant's approach is its ease of use. A major disadvantage is that the adjusted price would vary from household to household, in contrast with the theory that the households in the same market face similar market prices at a given time. Moreover, Cox and Wohlgenant's approach does not deal with measurement error problems. In this paper, I apply a modified version of Cox and Wohlgenant (1986) approach that is more suitable with the assumption of common market prices. In addition, the Deaton's approach is also calculated for comparison. The Deaton's approach is described in detail in Appendix A3. The modified Cox and Wohlgenant approach is described in detail as follows.

The Cox and Wohlgenant approach (CW) assumes that prices are functions food item characteristics. The quality effects can be identified as the difference between the unit value paid by the household and the communal average unit value, and therefore can be attributed to household characteristics. In this paper, the price/quality function is characterized by the following equation:

$$v_i = \bar{v}_i + \varphi_i x + \omega_i f_i + \sum_m b_i Z_{im} + e_i \quad (11)$$

Here, v_i is the unit value paid by the household for good i, $\bar{v}_i$ is the communal mean unit value, f_i is the share of food budget spent on food away from home, x is the household food expenditure per capita, e_i is the residual, and Z_{im} are the household characteristics in equation (1). This model assumes that quality is influenced by taste and convenience, and taste and convenience is influenced by the share of food away from home in the food budget and household expenditure per-capita, in addition to various household demographic characteristics.

The quality-adjusted prices for each good, denoted by p_i is generated by adding the communal mean unit value to the residual derived from (11).

$$p_i = \bar{v}_i + \hat{e}_i \quad (12)$$

These quality- adjusted prices proposed by Cox and Wohlgenant are inconsistent with the hypothesis that households in the same market face the same prices. Since $\hat{e}_i$ is random, p_i would vary among households in the same market. Moreover, empirical work by Niimi (2005) using a Vietnam's household survey indicated that the communal unit values are better proxies for market price than household specific values because the former help mitigate measurement errors. Therefore, I use the communal mean quality-adjusted prices, $\bar{p}_i$, as the corrected prices in the LA/AIDS model, which are defined as follows:

$$\bar{p}_i = \overline{\bar{v}_\iota + \hat{e}_\iota} \quad (13)$$

Thus, each household in the commune is assumed to face the same market price, represented by $\bar{p}_i$, for the "standard" good, i.e. without quality effects. By substituting $\bar{p}_i$ from (14) into equations (1) and (2) with the imposed restrictions of (4), (5), and (6), one can estimate the demand system and then use the results to construct the price and expenditure elasticities of food demand as given in equations (7), (8) and (9).

3. Data and Food Consumption in Vietnam

The data analyzed in this paper are from the 2006 Vietnamese Household Living Standards Survey (2006 VHLSS), a nationwide survey conducted in 2006. The 2006 VHLSS was conducted by Vietnam's General Statistics Office. The main objective of the survey is to collect data on household living standards, as measured by households' income and expenditure, as well as household members' occupation, health and education status. The survey was conducted in all of Vietnam's 64 provinces, and expenditure data were collected from 9189 households. Food consumption expenditure was obtained on both regular and holiday. The data were collected for both purchased foods and self-supplied foods (home production). The 9189 households were sampled from 3060 communes in Vietnam.

Data on food expenditures were collected for 56 food items. The analysis of this paper aggregates these food items into 10 food groups for food eaten at home, plus food away from home (FAFH). Expenditure shares are calculated as a fraction of total food consumption, including both purchased food and home food production. Table 1 describes the percentage shares of total food consumption for each of the 11 food groups: Rice (26 percent[2]), other staple foods (3 percent), pork (13 percent), poultry (6 percent), other meats[3] (3 percent), fish and seafood (10 percent), vegetables (7 percent), fruit (3 percent), drinks (5 percent), other foods (15 percent), and food consumed away from home (FAFH, 10 percent). Appendix A2 shows how each of the 56 food item is allocated to these food categories. The analysis assumes that food consumption is assumed to be weakly separable from the demand of non-food goods and services in order to estimate the demand for food categories separately from the demand for non-food commodities.

For Vietnam as a whole, 53 percent of household expenditure is devoted to food, 55 percent in rural areas and 48 percent in urban areas. Rice is the most important single food. On average, expenditure on rice per month is about 50 thousand VND per capita in rural areas and 44 thousand VND per capita in urban areas. Rice accounts for nearly 30 percent of food expenditure in rural areas and 17 percent in urban areas. 'Other foods' category is the second most important food group in terms of expenditure, accounting for nearly 15 percent of total food

[2] The percentages in parentheses represent average percentages of all households.
[3] This category includes beef, buffalo meat, other meat, and processed meat, in which beef and buffalo meat constitute about 63 percent in terms of value.

expenditure. This category is comprised of diverse foods such as fat and oil, cakes, fish sauce, spice, sugar, salt, condensed milk, ice creams. Pork is the most important meat, amounting to 13 percent of food expenditure in both rural and urban areas. Food away from home (FAFH) makes up nearly 10 percent of food expenditure, yet its share is much larger in urban areas than in rural areas. In urban areas, over 16 percent of food expenditure is allocated to FAFH; while in rural areas, the corresponding figure is 7 percent. Thus, while FAFH is the second most important food group in urban areas (after rice), it only ranks fifth among eleven food categories in rural areas.

The differences in food consumption patterns across different regions are remarkable. In the regions with large percentages of urban population, such as the South East and the South Central Coast, rice expenditure percentages are lower while FAFH percentages are higher than the other regions. The largest discrepancy is observed when comparing the most urban region- the South East- with the least urban region- the North West. In the North West, rice consumption is 38 percent of food expenditure while FAFH is less than 3 percent. In the South East, rice is just 18 percent and FAFH is 15 percent of food expenditure.

Differences in consumption patterns are also observed across different income groups. The population can be divided into five quintiles, based on the household real expenditure. Among the poorest quintile, rice occupies 41 percent, meat and fish 26 percent, and FAFH 3 percent of food expenditure. In contrast, among the richest quintile, rice consumption is 14 percent, meat and fish 34 percent, and FAFH 18 percent of food expenditure. It is clear that higher income households rely more on meat, fish and FAFH and less on rice than the poorer households. There are also differences in food consumption patterns between ethnic minorities and the ethnic majority . As a group, ethnic minorities consumes less meat, fish and FAFH, and more rice, than the ethnic majority group. Regarding occupation, farmers eat more rice, less meat, and fish and FAFH, than non-farmers.

Unit values are calculated for each category by dividing purchased food value by purchased food quantity. To construct aggregate unit values for food groups, unit values for individual food items are calculated by dividing expenditure by quantity for each individual food item. For some foods, such as other meat and other seafood, data were collected in values but not on quantities. These items were dropped from estimating the unit value of the food group to

which these food items belong. Food group unit values are calculated as weighted averages of the individual unit values, with the weights being the (household- level) expenditure shares of the individual goods within the food group. For households that reported zero consumption, the unit values were assumed to be the same as the average unit values of the other households in the same geographical groups, in this case the communes.

Following Cox and Wohlgenant (1986) and Niimi (2005), I drop as outliers all unit values that are more than five standard deviations from their means, and replaced those unit values with the mean of the unit values of households in the communes. From the individual unit values, one can calculate the communal unit values as the mean of individual unit values of the households in the commune. Since no quantity for food away from home (FAFH) is reported, provincial price deflators are used as a proxy for the price of FAFH. The unit value data are summarized in Table 2.

Table 2 also indicates the degree of non-consumption in our study. It shows that most of the food groups are consumed by nearly all households. Rice, other food, pork, vegetables, fish and fruits are all consumed by more than 98 percent of the sample. The two least consumed groups are other meats and FAFH, which are still consumed by nearly 80 percent of the households in the sample. Overall, the data show that zero consumption is not a serious problem.

Table 3 summarizes the variables used in the analysis in this paper. The regressors include the prices (with proxies being individual unit values, communal unit values or quality-corrected unit values) of 11 food categories, log of food expenditure per capita, household demographic variables and variables that control for community, geographic and seasonal differences. The demographic vector includes household head's age, household size, household head's years of schooling, the proportion of infant (<3 years), child (3-15 years) and elderly household members (>59 years), and dummy variables indicating whether the household head is an ethnic minority or whether the head is female. The average household has 4.3 members. The average head's age is 49 years old and the average head's schooling is 7 years. The proportions of infants, children and elderly are 0.04, 0.20 and 0.13, respectively. About 25 percent of households' heads are female heads and 15 percent are ethnic minorities.

The community variables include binary variables for mountainous and seaside communes. The geographical variables consist of dummy variables for urban areas, and

Vietnam’s seven regions (with the Red River Delta being the default region). The seasonality variables are dummy variables for different quarters during the year.

Table 1: Shares of Food Expenditures (%)

	Rice	Other Staples	Pork	Other meats	Poultry	Fish	Vegetables	Fruits	Other foods	Drink	FAFH	Food share
All	26.4	2.9	13.1	5.6	2.9	9.9	6.7	3.4	14.5	4.9	9.6	53.3
Rural	29.6	3.0	13.1	6.0	2.4	9.6	6.8	3.2	14.4	4.6	7.3	55.0
Urban	16.9	2.6	13.1	4.5	4.5	10.8	6.4	4.1	15.0	5.7	16.4	48.2
Red River Delta	26.6	2.8	15.4	6.3	3.7	6.3	7.0	3.5	13.0	4.9	10.3	49.1
North East	30.8	3.0	15.4	8.9	2.5	5.5	7.7	3.2	12.3	4.4	6.4	57.2
North West	38.4	2.9	12.9	8.8	3.4	5.9	7.5	2.8	10.0	4.6	2.7	67.6
North Central Coast	31.6	3.3	12.4	5.2	2.9	10.2	6.0	2.8	13.9	4.6	7.0	51.1
South Central Coast	22.3	2.9	10.2	3.4	3.8	12.3	5.9	3.5	16.5	5.0	14.2	51.4
Central Highlands	30.2	3.4	11.4	5.2	3.7	9.4	6.8	3.1	14.8	5.8	6.1	53.2
South East	18.3	3.0	12.1	3.8	3.3	11.8	6.9	4.0	16.7	5.5	14.5	52.9
Mekong River Delta	23.4	2.5	11.8	4.2	1.5	15.4	6.1	3.6	16.7	4.6	10.0	53.9
Quintile 1	41.4	3.3	10.5	5.7	1.5	8.4	7.3	2.5	13.3	3.5	2.7	67.6
Quintile 2	31.6	2.8	12.9	5.9	2.0	10.3	7.2	3.0	14.7	4.0	5.4	58.0
Quintile 3	25.7	2.9	14.2	5.8	2.6	10.4	6.8	3.4	14.8	4.8	8.7	53.1
Quintile 4	20.2	2.9	14.1	5.4	3.4	10.6	6.5	3.6	15.0	5.4	12.9	47.5
Quintile 5	13.7	2.7	13.6	5.1	5.1	9.8	5.9	4.6	14.9	6.8	18.0	40.8
Ethnic majority	24.5	2.8	13.2	5.2	3.1	10.4	6.6	3.6	15.0	5.0	10.7	51.0
Ethnic minorities	37.5	3.6	12.1	7.8	2.2	7.1	7.3	2.6	12.0	4.4	3.4	66.3
Non-farmer	17.6	2.7	13.0	4.1	4.2	11.4	6.2	3.9	15.6	5.6	15.7	49.7
Farmer	29.8	3.0	13.1	6.2	2.5	9.3	6.9	3.2	14.1	4.6	7.2	54.7

Table 2: Unit Values of Food Categories and Percentage of Consuming Households

	Individual unit vales		Communal mean unit values		Percentage of consuming households
	Mean	S.D.	Mean	S.D.	
Rice	5.18	1.37	5.23	1.17	99.9
Other staples	8.30	4.67	8.33	3.64	94.3
Pork	28.81	7.28	28.84	5.81	99.6
Poultry	31.05	11.74	30.87	10.37	93.3
Other meats	42.31	19.66	41.58	16.63	79.2
Fish	18.41	11.50	18.43	9.84	98.5
Vegetables	4.74	2.44	4.75	1.86	99.7
Fruits	3.36	2.63	3.26	2.17	98.5
Other foods	9.82	15.89	9.82	10.36	100.0
Drinks	19.38	24.03	19.36	14.90	98.5
FAFH	0.98	0.10	0.98	0.10	78.3

** The unit values are in thousand VND per kg, except per liter for drink and except FAFH in which provincial deflators are used.*

Table 3: Definition and Description of Variables

	Mean	S.D.		Mean	S.D.
Log of prices of					
Rice	1.63	0.21	Proportion of infants	0.04	0.09
Staple	2.03	0.43	Proportion of children	0.20	0.20
Pork	3.34	0.20	Proportion of elderly	0.13	0.26
Poultry	3.37	0.35	***Community variables***		
Other meat	3.63	0.48	Near sea	0.05	0.23
Fish	2.80	0.46	Mountainous	0.30	0.46
Vegetables	1.47	0.44	***Geographical variables***		
Fruits	0.97	0.70	Urban	0.25	0.43
Other foods	1.95	0.83	North East	0.14	0.35
Drink	2.74	0.78	North West	0.05	0.21
FAFH	-0.02	0.1	North Central Coast	0.11	0.31
Log of food expenditure	7.79	0.5	South Central Coast	0.09	0.29
Demographic Characteristics			Central Highlands	0.06	0.24
Head's age	49.4	13.6	South East	0.13	0.34
Household size	4.25	1.69	Mekong River Delta	0.20	0.40
Female-headed	0.25	0.43	*Seasonality*		
Head's schooling	6.97	3.70	Quarter 2	0.45	0.5
Ethnic minority	0.15	0.36	Quarter 3	0.35	0.5
			Quarter 4	0.51	0.48

4. Empirical Results

The system of demand equations is estimated using Seemingly Unrelated Regressions (SUR) with homogeneity and symmetry restrictions imposed. To preserve the adding-up restriction, one equation (the FAFH in this case) is omitted. The coefficient of this equation is obtained by imposing the adding-up restriction in (4). The elasticities are all evaluated at mean values.

Table 4 shows expenditure elasticities and the Marshallian (uncompensated) and own-price elasticities, obtained by four methods: SUR with individual unit values, SUR with communal unit values, modified Cox and Wohlgenant (CW)'s quality-adjusted approach, and Deaton's approach to correct unit value bias. Expenditure elasticities are all positive, implying all eleven food categories are normal goods. Results from the model with individual unit values

are very different with the three other models. It implies that using individual unit values as prices might lead to remarkably different results from using some kinds of correction models.

The CW quality-adjusted model yields slightly different estimates from the model with communal unit values and with the Deaton's model. We would use the results from the CW quality-adjusted model as the basis for the analysis in this paper. Very few studies have been conducted to compare these correction methods so it is impossible to derive the conclusion about which method performs best. Yet, the Deaton's approach has received criticism from some authors (Huang and Lin 2000), Niimi (2002), Gibson and Rozelle (2002) for being unsatisfactory, which motivated me to choose the modified CW approach, with communal quality-corrected unit values being proxies for prices, as the main model for analysis.

For most of the food groups, the unadjusted communal value method and the CW-adjusted elasticities are similar. The food groups for which there are important differences between the two models are rice, other meat and FAFH. Therefore, a simple model that ignores the differences in quality may lead to significant bias in the estimates of the elasticities of rice, other meat and FAFH.

Table 4: Expenditure and Price Elasticities

Expenditure elasticities

	Individual	Communal	C& W	Deaton
Rice	0.96	0.37	0.31	0.53
Staples	1.00	0.96	0.99	0.99
Pork	1.01	1.13	1.13	1.12
Poultry	1.01	1.10	1.10	1.20
Other meats	1.02	1.63	1.75	1.73
Fish	1.03	1.05	1.07	0.99
Vegetables	0.99	0.85	0.84	0.69
Fruit	1.00	1.20	1.23	1.13
Other foods	0.98	0.98	0.95	0.98
Drink	1.02	1.44	1.46	1.52
FAFH	1.07	2.10	2.24	2.08

Marshallian own-price elasticities

	Individual	Communal	C& W	Deaton
Rice	-0.89	-0.73	-0.80	-0.69
Staples	-0.75	-0.74	-0.75	-0.73
Pork	-0.79	-0.79	-0.83	-0.55
Poultry	-1.09	-1.08	-1.07	-0.90
Other meats	-0.94	-0.83	-0.95	-1.04
Fish	-0.94	-0.99	-0.99	-1.24
Vegetables	-0.97	-0.99	-1.00	-0.88
Fruit	-0.93	-0.93	-0.94	-0.88
Other foods	-1.07	-1.01	-1.01	-0.89
Drink	-1.01	-1.03	-1.00	-1.01
FAFH	1.11	-2.65	-2.03	N/A*[4]

FAFH and other meat (mostly beef) are the two most expenditure-elastic food groups. In contrast, rice is the least expenditure-elastic good. Rice, other staples, vegetables, and other foods are necessities (i.e. they have expenditure elasticities less than 1), while pork, poultry, beef, fish, fruit, drinks and FAFH are luxury goods (expenditure elasticities greater than 1). Thus when household income increases, the expenditure shares of meats, fish, fruit, drinks and FAFH will increase while the shares of rice, staples, vegetables and other foods decrease.

[4] As the price index of FAFH is assumed to be the same for every household in the province, there is no variation of unit values within a commune. Thus, the Deaton's approach cannot construct the price elasticity of FAFH.

The estimated expenditure elasticity for rice is 0.31 after quality adjustment by CW method. Estimates from past studies vary widely, from 0.09 to 0.83 (Haughton et al 2004, Benjamin and Brand 2004, Canh 2008, Niimi 2005, Minot and Goletti 2000). These estimates may differ for several reasons. First, they use different specifications (double-log model, Engel curve estimation or AIDS model). Second, some studies estimate only the demand for rice (Haughton et al 2004), while others cover both food and non-food (Canh 2008). Third, except for Canh 2008, all previous studies examine food demand in Vietnam in 1990s, while the estimates presented here are based on 2006 data. Food demand patterns may change considerably as income and nutritional status improves.

Because the expenditure elasticity of rice is lower than the elasticities for all other food groups, the importance of rice in the Vietnamese diet will decrease as economic growth continues. This trend has been observed in recent years. In 1993, rice expenditure was 30 percent of total consumption expenditures and contributed 75 percent of calorie intake (Minot and Goletti 2000). In 2006, rice accounts for only 14 percent of total consumption expenditure, 26 percent of food expenditure, and 59 percent of calorie intake. However, rice will certainly remain the most important single food item in the Vietnamese diet for many years to come.

Future expenditures on meat, fish and fruit will increase significantly because their expenditure elasticities are larger than one. Particularly, the role of beef (in the 'other meat' category) and fruit will rapidly increase if Vietnam maintain its rapid economic growth.

The expenditure elasticity of FAFH is very high, at 2.2. Therefore, income growth will lead to a significant increase in FAFH share among Vietnam's food consumption, shifting away from at-home diet to outside meals. In 1993, FAFH accounts for 1 percent and 2 percent of food expenditure in rural North and rural South, and 6 percent and 10 percent of food expenditure in urban North and urban South (Benjamin and Brandt 2004). In 2006, FAFH represents 7 percent and 16 percent of food expenditure in rural and urban areas, respectively. This growing trend of FAFH share will continue in the future as Vietnam's economy develops and its population becomes more urbanized.

Table 4 also shows estimates of own-price elasticities in Vietnam. It reports both the Marshallian (uncompensated) and Hicksian (compensated) price elasticities. As expected, all the own-price elasticities are negative. Based on the quality-adjusted Marshallian price elasticities,

FAFH, poultry and other foods are relatively price elastic foods, with Marshallian price elasticities above unity. Meanwhile, rice, other staples, pork, other meats, fish, and fruit have Marshallian price elasticities of less than unity.

The most price-elastic food is FAFH (-2.0); an increase in its price will reduce its consumption substantially. Poultry also has a rather large own-price elasticity (-1.07). Thus, a uniform increase in the price of all foods will make households cut their consumption of FAFH and poultry considerably, while they are more reluctant to reduce their consumption of rice, staples and pork. Yet, the own-price elasticities of all foods are rather large, with their absolute values greater than 0.7, implying that household food consumption is sensitive to food price changes.

Tables 5 provide detail information on the own-price and cross-price elasticities of food demands. Most of the Marshallian cross-price elasticities are very small, at less than 0.1. Some cross-price effects are important for rice and FAFH. As rice is the most important food, the consumption of all other food groups is significantly affected by the price of rice. Except for vegetables and FAFH, all other foods are considered complements to rice. The cross-price elasticities between rice and other food groups are the highest in terms of absolute values for FAFH (+0.30), drink (-0.29), other meats (-0.20), poultry (-0.18) and fruit (-0.18). Many food consumption items are also sensitive to the price of FAFH (represented by the general province-level price). Households tend to move to the traditional diet, based on rice and other staples as FAFH price increases. Among the other food groups besides rice and FAFH, only the price of pork has important impacts on other food consumption. An increase in the price of pork leads to a reduction in the other meat products (poultry and other meats), and a cut in the expenditure on staples other than rice, vegetables, fruits, and FAFH, but leads to an increase in the consumption of rice, fish and other foods. Therefore, rice, fish and other foods are substitutes for pork, while all the other food groups are complements.

Table 5: Marshallian Owned- Price and Cross-Price Elasticities of Food Demand

	With respect to the price of										
	Rice	Staples	Pork	Poultry	Other meats	Fish	Vegetables	Fruit	Other foods	Drink	FAFH
Rice	-0.80	0.00	0.07	0.01	0.02	0.02	0.05	0.01	0.01	0.00	0.29
Staples	-0.14	-0.75	-0.14	-0.03	-0.06	-0.11	0.06	0.01	-0.03	-0.04	0.23
Pork	-0.08	-0.03	-0.83	-0.04	0.00	0.03	-0.11	-0.03	0.03	0.00	-0.07
Poultry	-0.18	-0.02	-0.09	-1.07	0.06	-0.03	0.08	0.00	0.02	0.00	0.14
Other meats	-0.20	-0.08	-0.09	0.08	-0.95	0.10	0.03	0.04	0.00	0.01	-0.69
Fish	-0.14	-0.03	0.05	-0.02	0.05	-0.99	-0.06	0.00	-0.03	-0.01	0.11
Vegetables	0.07	0.03	-0.17	0.08	0.04	-0.06	-1.00	0.00	0.00	0.02	0.15
Fruits	-0.18	0.00	-0.11	-0.01	0.05	-0.01	-0.03	-0.94	0.02	0.02	-0.04
Other foods	-0.14	-0.01	0.05	0.01	0.02	-0.01	-0.01	0.01	-1.01	0.02	0.11
Drink	-0.29	-0.04	-0.04	-0.02	0.01	-0.06	-0.02	0.01	-0.01	-1.01	0.00
FAFH	0.30	0.03	-0.24	0.02	-0.23	0.00	0.01	-0.05	-0.02	-0.04	-2.03

Shading areas: significant at 5%

Disaggregated elasticities

In order to have a better understanding of food demand in Vietnam, this subsection examines the expenditure and price elasticities for different groups by running separate regressions for these groups. This information is important for policymakers in formulating as well as in evaluating, the possible effects of food policies and programs on different groups. Table 6 summarizes expenditure elasticities for different household groups.

Households in urban areas have higher expenditure elasticities than those in rural areas for rice, FAFH, drinks and other meats, but lower elasticities for other food groups. Thus, as income rises, urban households are more likely to spend on rice, other meats, drinks and FAFH and less likely to spend on other foodstuffs than are rural households.

The food patterns are also somewhat different across regions. The income elasticity of rice is lowest in the North and highest in the South. In contrast, the income elasticity of FAFH is higher in the Center and the North than in the South. Nevertheless, the general pattern is similar for all three regions. Some exceptions concern fish and other staples. Fish demands are relatively income elastic in the North and in the Center but income inelastic in the South. In contrast, other staples demand is rather inelastic in the Center while elastic in the South. Thus, households in the Center tend to prefer to buy more fish and rather than other staples as their incomes rise, whereas Southern households are more likely to spend more on staples and less on fish as their income rises.

Regarding the expenditure groups, the poorest 20 percent of households have relatively high expenditure elasticities for poultry, fish, vegetables and fruit than other groups. Interestingly, the mean expenditure elasticity for rice of the poorest group is lower than that of the richest group, although it is higher than the other quintiles. The relatively high expenditure elasticity for rice (0.46) in this group implies that these households in the poorest group may be constrained in their access to food, as they increase significantly the consumption of rice, the most basic component in the Vietnamese diet, as their income rises. Poorer households tend to increase their food consumption when their incomes rise more than do rich households. In fact, except for rice and staples, the expenditure elasticities of the poorest 20 percent of Vietnamese households for all the other nine food groups are equal or greater than one. Meanwhile, for the

richest 20 percent, only five among 11 food groups have expenditure elasticities that are greater than unity.

Turning to the Marshallian own-price elasticities, rural demand is more price elastic for rice, poultry, other meats, vegetables and fruit but less price elastic for the other food. Geographically, Vietnam has three regions: the North (including North East, North West, and Red River Delta), the Center (including North Central Coast and South Central Coast) and the South (including Central Highland, Mekong River Delta and South East). Households in the Center have the highest price elasticity for rice but the lowest price elasticity for FAFH. In general, households in the South are more price elastic than those in the North and the Center.

When the prices of rice, other staples and pork increase, the poorest quintile is most likely to cut their corresponding food consumption since their demand for such foods is more price elastic than the demands of other groups. Because rice, other staples and pork supply the basic diet for most Vietnamese, poor households' food security and nutrition are vulnerable to food price increases. On the other hand, the richest households tend to reduce their share of FAFH and drink more than the poor do as the prices of these food groups increase.

Table 6: Disaggregated Expenditure and Marshallian Price Elasticity

	Rice	Staples	Pork	Poultry	Other meats	Fish	Vegetables	Fruits	Other foods	Drinks	FAFH
Expenditure elasticity											
Rural	0.25	1.00	1.27	1.15	1.68	1.09	0.88	1.23	0.97	1.45	2.12
Urban	0.46	0.96	0.88	0.99	1.75	0.97	0.75	1.14	0.91	1.46	2.49
North	0.22	1.00	1.07	1.17	1.89	1.18	0.78	1.31	0.99	1.35	2.37
Center	0.31	0.91	1.13	1.02	1.79	1.03	0.85	1.16	0.92	1.50	2.39
South	0.39	1.02	1.20	1.05	1.56	0.97	0.87	1.15	0.92	1.52	2.11
Quintile 1	0.46	0.67	1.15	1.29	1.35	1.39	1.16	1.14	1.02	1.06	1.48
Quintile 2	0.41	0.98	1.18	1.08	1.16	1.30	1.11	1.00	0.99	1.13	1.87
Quintile 3	0.37	1.08	1.23	1.00	1.22	1.34	0.87	0.81	0.91	0.96	2.29
Quintile 4	0.42	0.89	1.14	0.89	1.23	1.12	0.93	0.96	0.86	1.25	2.44
Quintile 5	0.55	0.91	0.84	1.01	1.53	0.93	0.74	1.11	0.91	1.39	2.46
Marshallian own-price elasticity											
Rural	-0.82	-0.74	-0.81	-1.07	-1.07	-0.99	-1.02	-0.97	-1.00	-1.00	-1.80
Urban	-0.72	-0.76	-0.94	-1.05	-0.46	-0.99	-0.91	-0.81	-1.03	-1.02	-2.24
North	-0.80	-0.85	-0.60	-1.01	-0.98	-0.89	-0.96	-0.92	-0.99	-0.97	-1.97
Center	-0.90	-0.69	-0.80	-1.12	-0.66	-0.96	-0.97	-0.89	-1.04	-1.07	-1.23
South	-0.81	-0.70	-1.04	-1.12	-1.01	-1.11	-1.02	-0.98	-1.02	-0.99	-2.66
Quintile 1	-0.89	-0.91	-0.98	-1.01	-1.09	-1.05	-1.03	-0.97	-0.99	-0.99	-1.26
Quintile 2	-0.87	-0.64	-0.89	-1.02	-1.14	-0.99	-1.04	-0.99	-1.02	-1.01	-1.51
Quintile 3	-0.84	-0.77	-0.76	-1.08	-1.07	-1.01	-0.97	-0.97	-1.02	-0.98	-1.79
Quintile 4	-0.83	-0.66	-0.73	-1.11	-0.93	-0.96	-1.00	-0.92	-1.02	-1.04	-1.96
Quintile 5	-0.82	-0.70	-0.84	-1.04	-0.54	-0.95	-0.94	-0.88	-0.99	-1.05	-2.29

5. Conclusion

This paper analyzed the food consumption patterns of Vietnamese households, by estimating a complete demand system. Demand elasticities are estimated using the AIDS model and the latest Vietnamese household survey data. The results indicate that food consumption pattern in Vietnam are affected by income and prices, as expected, and also by socio-economic and geographic factors.

All food items have positive expenditure elasticities and negative own-price elasticities. In particular, rice has mean expenditure elasticity of 0.36 and mean own-price elasticity of -0.80. Thus, an one percent increase in the price of rice will reduce rice consumption by 0.8 percent, on average. On the other hand, an one percent increase in the income would lead to an increase in rice demand by 0.36 percent. Therefore, policies that aim at increasing household income (income policies) may be ineffective compared with policies that control prices (price policies) in the case of rice. In contrast, income policies may be more effective in enhancing meat and fish consumption than price policies, as the expenditure elasticities of these foods are higher than their own-price elasticities. However, both price and income policies are important, as the expenditure and price elasticities are highly significant.

This study indicates that demand functions in urban and rural areas, and across regions and income groups are different. It points out that targeted food policies should be formulated based on specific food demand patterns in the groups. Socio-economic factors such as household size and composition, as well as household's head age and education affect food consumption significantly in most cases.

Recently, a worldwide food price crisis has occurred in many developing countries, including Vietnam. During the first nine months in 2008, food prices increased by more than 30 percent and rice prices by nearly 60 percent. Because own-price elasticities are high for most food groups, such a price hike may have a severe impact on food consumption and endanger the food security and nutritional status of Vietnam's population.

Vietnamese food consumption patterns have been changing over the past 15 years. In particular, the role of rice has diminished while the consumption shares of meat, fish, fruit and

food eaten away from home have all increased considerably. Future studies based on a panel and time series data could shed some light on those changing food consumption pattern.

References

Albay, C., I. Boz, and W.S. Chern (2007). "Household Food Consumption in Turkey," *European Review of Agricultural Economics* 34(2): 209-231.

Alfonzo, L., and H. H. Peterson (2006). "Estimating Food Demand in Paraguay from Household Survey Data," *Agricultural Economics* 34: 243-257.

Benjamin, D. and L. Brandt (2004). "Agriculture and Income Distribution in Rural Vietnam under Economic Reform: A Tale of Two Regions" in Glewwe, P., Agrawal, N. and Dollar, D. (eds), *Economic Growth, Poverty, and Household Welfare in Vietnam*, World Bank, Washington, D. C.

Brubakk, L. (1997). *Estimation of Price Elasticities from Norwegian Household Survey Data*, Discussion Papers No. 202, Statistics Norway Research Department, Oslo.

Canh, L.Q. (2008), "An Empirical Study of Food Demand in Vietnam," mimeo, Department of Economics, University of Kansas.

Cox, T.L., and M. K. Wohlgenant (1986). "Prices and Quality Effects in Cross-Sectional Demand Analysis," *American Journal of Agricultural Economics* 68: 908-919.

Deaton, A., (1988). "Quality, Quantity, and Spatial Variation of Price," *American Economics Review* 78: 418-429.

Deaton, A. (1987). "Estimation of Own- and Cross-Price Elasticities from Household Survey Data," *Journal of Econometrics* 36: 7-30.

Deaton, A. (1990). "Price Elasticities from Survey Data: Extensions and Indonesian Results," *Journal of Econometrics*. 44: 281-309.

Deaton, A. J., and J. Muellbauer (1980). "An Almost Ideal Demand System," *American Economics Review* 70: 312-326.

Dong, D., J.S. Shonkwiler, and O. Capps Jr. (1998). "An Estimation of Demand Functions Using Cross-Sectional Household Data: the Problem Revisited," *American Journal of Agricultural Economics* 80: 466-473.

Fan, S., E.J. Wailes, and G.L. Cramer (1995). "Household Demand in Rural China: A Two-Stage LES-AIDS Model," *American Journal of Agricultural Economics* 77:54-62.

Friedman, J. and J. Levinsohn (2002). "The Distributional Impacts of Indonesia's Financial Crisis on Household: A "Rapid Response" Methodology", *World Bank Economic Review* 16: 397-423.

Gao, X.M., E.J. Wailes, and G.L. Cramer (1994). "A Synthetic Demand System: An Application to U.S. Consumer Demand for Rice and Selected Rice Substitutes," *Review of Agricultural Economics* 16: 27-38.

Gao, X.M., E. J. Wailes, and G.L. Cramer (1996). "A Two-Stage Rural Household Demand Analysis: Microdata Evidence from Jiangsu Province, China," *American Journal of Agricultural Economics* 78: 604-613.

Gao, X.M., E. J. Wailes, and G.L. Cramer (1997). "A Microeconomometric Analysis of Consumer Taste Determination and Taste Change for Beef," *American Journal of Agricultural Economics* 79:573-582.

Gracias. A., and L.M. Albisu (1998). "The Demand for Meat and Fish in Spain: Urban and Rural Areas," *Agricultural Economics* 18: 359-366.

Heien, D., and CR. Wessell (1990). "Demand System Estimation with Microdata: A Censored Regression Approach," *Journal of Business and Economic Statistics* 8: 365-371.

Haughton, J., L.T., Duc, N.N., Binh, and J. Fetzer (2004), "The Effects of Rice Policy on Food Self-Sufficiency and on Income Distribution in Vietnam," Working Papers, Ford Foundation & General Statistics Office Project, Vietnam.

Houthakker, H. S., 1952. Compensated changes in quantities and qualities consumed. *Review of Economic Studies* 19, 155-164.

Huang, K. S., Lin, B. H., 2000. *Estimation of food demand and nutrient elasticities from household survey data*. Technical Bulletin No. 1887, Food and Rural Division, Economic Research Service, U.S. Department of Agricultural, Washington DC.

Lazaridis, P. (2003). "Household Meat Demand in Greece: A Demand System Approach Using Microdata," *Agribusiness* 19 (1): 43-59.

Minot, N., and F. Goletti (2000). *Rice Market Liberalization and Poverty in Vietnam*, Research Report 114, International Food Policy Research Institute, Washington D.C.

Nelson, J. A. (1991). "Quality Variation and Quantity Aggregation in Consumer Demand for Food," *American Journal of Agricultural Economics*: 1204-1212.

Nicita, A. (2004). *Who Benefited from Trade Liberalization in Mexico? Measuring the*

Effects on Household Welfare, World Bank Policy Research Working Paper No. 3266,

World Bank, Washington, D.C..

Niimi, Y. (2005). "An Analysis of Household Responses to Price Shocks in Vietnam: Can Unit Value Substitute for Market Prices", PRUS Working Paper no. 30, Poverty Research Unit of Sussex, Department of Economics, University of Sussex.

Park, J.L., R.B. Holcomb, K.C. Raper, and O.Capps, Jr. "A Demand System Analysis of Food Commodities by U.S. Households Segmented by Income," *American Journal of Agricultural Economics* 78: 290-300.

Prais, S. J. and H. S. Houthakker (1955). *The Analysis of Family Budgets*, 2nd ed. (1971), Cambridge University Press, Cambridge.

Shonkwiler, J. S., Yen, S. T., 1999. Two-step estimation of censored system of equations. *American Journal of Agricultural Economics* 30, 491-501.

Yen, S.T., C. Fang, and S-J. Su, (2004). "Household Food Demand in Urban China: A Censored System Approach," *Journal of Comparative Economics* 32: 564-585.