2014

ENGEL'S LAW IN VIETNAM AND THE PHILIPPINES:
EFFECTS OF IN-KIND CONSUMPTION ON INEQUALITY AND POVERTY

Atsushi Maki | Tokyo International University
Satoshi Ohira | Keio University

Engel's Law in Vietnam and the Philippines: Effects of In-Kind Consumption on Inequality and Poverty

Atsushi Maki*

Department of Economics, Tokyo International University

Harvard Yenching Institute

and

Satoshi Ohira

Department of Economics, Keio University

Abstract

This paper focuses on the Philippines and Vietnam where poverty alleviation programs play a critical role in maintaining minimal living standards, making it essential to understand how impoverished households make ends meet through in-kind transactions. Using Engel curves including and excluding in-kind consumption, we found that when we include in-kind consumption in consumption expenditure, the Engel curve is monotonic downward sloping in Vietnam and in the Philippines. On the other hand, when we exclude in-kind consumption from consumption categories, the Engel curve was hump-shaped. Contrary to Engel's Law, we find that the Engel curve is upward sloping in very poor households, meaning that food expenditures as a percentage of income increases with income. Our findings are also suggestive about the different effects of in-kind consumption depending on the stages of economic development that may be relevant in terms of economic and social policies in developing countries especially those targeting improvement in the standard of living for poor households.

1. Introduction

In developing economies many transactions occur outside of markets and involve bartering of goods and services. The challenge for economists is to capture the extent and impact of such in-kind transactions; not to do so creates an erroneous impression of living standards and patterns of consumption. This paper focuses on the Philippines and Vietnam where poverty alleviation programs play a critical role in maintaining minimal living standards, making it essential to understand how impoverished households make ends meet through in-kind transactions.

Economists treat in-kind consumption as non-cash based consumption as opposed to cash-based consumption. Viewed in terms of the scope of the transaction process, in-kind consumption is treated as a household consumption expenditure without through markets. When the consumer obtains goods outside of markets, the goods obtained through such transactions without money-based exchange are called in-kind goods.

In-kind consumption plays an important role for the poor in developed and developing countries. In the cases of developed countries, the role of in-kind transaction is especially relevant to government subsidy programs. Economists have a question theoretically and empirically about the role of in-kind consumption and whether or not there are any differences between in-kind and cash transfers. The answer according to standard neoclassical theory is that there is no difference between the two. Consumers maximize their utility subject to their budget constraint. If the amount of transfer from the government is excessive, households will resell some of the received resources to others. And if the amount is inadequate, they will seek to buy additional resources by trading some of their initial endowments. From this standard perspective, the only important aspect of the government subsidy program is the amount of additional resources provided, not the type of resources. For this reason, the difference between in-kind and cash transfers is not considered.

Government subsidy programs tend to provide in-kind transfers rather than cash transfers. Some research empirically examines cases where in-kind and cash transfers have a different impact. [1] They assume market imperfection as a hypothesis and that the government's subsidies based on in-kind transfer deviate from the market optimum. Fraker (1990), for example, examines the different policy impact of in-kind and cash transfers.

In contrast, there are studies that support the standard neoclassical view that the impact of in-kind and cash transfers is similar. (Slesnick, 1996 and Hoynes and

Schanzenbach, 2009) Slesnick (1996) empirically analyzed the effect of in-kind subsidies for food, housing and health care provided by the US government using the *Consumer Expenditure Survey* (CEX) compiled by the Bureau of Labor Statistics. He concluded that multiple goods transfers are essentially equivalent to cash grants and that in-kind transfers by the government have a positive impact regarding improvement in living standards on poor households. Hoynes and Schanzenbach (2009) analyzed the effect of the Food Stamp Program (FSP) in the US as a case study of in-kind transfer programs using the *Panel Survey of Income Dynamics* (PSID). They concluded that households respond similarly to one dollar in cash income and one dollar in food stamps and that due to the introduction of the FSP, overall food expenditure increased while out-of-pocket food spending decreased.

Cash (or credit card) transactions dominate in advanced market economies. In developed countries, government subsidies are the main source of in-kind consumption. However, to better understand developing economies it is essential to understand the dynamics of in-kind transactions because they are a significant factor influencing household consumption and welfare. Generally, in developing countries, sources of in-kind consumption include: 1) subsidies for food, housing and health care through coupons and other instruments distributed by the government; 2) consumption of food or housing-related goods produced by households as household production, especially by agricultural households; 3) barter of food between households in rural areas; and 4) gifts of food from neighbors or communities.

In our analysis we examine the validity of Engel's Law in developing countries, i.e. does food as a percentage of household spending decline with rising income, and how this is influenced by observed patterns of in-kind consumption. Engel's Law is one of the most important empirical laws for analyzing consumer behavior, and has been verified by cross-sectional data from many countries. The downward sloping Engel curve demonstrates the negative correlation between income (or total expenditure) and the proportion spent on food. However, the negative correlation between the two is not always validated by family expenditure surveys conducted in developing countries. For example, Kedir and Girma (2007) estimated quadratic Engel curves using the *1994 Ethiopian Urban Household Survey*. Maki and Kamwe (2012) analyzed consumer behavior in Tanzania using the *2007 Tanzanian Household Budget Survey*. They found a hump-shaped Engel curve where the hump or the peak of the Engel's coefficient appears in those households classified as very poor.

In the present analysis, using the 2006 *Vietnam Household Living Standard Survey* compiled by the Statistics Bureau in Vietnam and the 2006 *Family Income and Expenditure Survey* compiled by the National Statistical Office of the Philippines, we found again an inverse U- shaped Engel curve when we exclude in-kind consumption from total expenditure in the survey. This indicates that as cash-based total consumption expenditure increases, the Engel's coefficient excluding in-kind food consumption (i.e. food purchases as a proportion of cash-based total expenditure) increases in low-income households, and the Engel's coefficient excluding in-kind consumption reaches its maximum value among these low-income households. After reaching the peak, the Engel's coefficient decreases monotonically as total consumption expenditure increases. The hump-shaped Engel curve leads to two interesting conclusions regarding empirical analysis of consumer behavior. The first is: Engel's Law does not always hold, particularly among poor households in developing countries. The second: the income elasticity of demand for food is elastic in the left-hand side of the income level where the Engel's coefficient peaks. Though we usually observe that income elasticity for food expenditure is inelastic, this is not true among poor households excluding in-kind consumption in Vietnam and in the Philippines and including both cash and in-kind consumption in Ethiopia and in Tanzania.

Based on the *Vietnam Household Living Standard Survey* and the *Family Income and Expenditure Survey* in the Philippines, we focus on three issues: 1) the shape of the Engel curve, particularly in low income households and whether or not an inverse U-shaped Engel curve exists; 2) the specification of the adult equivalence scale and changes in inequality measures such as the Gini coefficient, depending on the different specification of the adult equivalence scale; and 3) the role of in-kind consumption on food and non-food expenditures in consumer behavior.

Section 2 explains the characteristics of the *2006 Vietnam Household Living Standard Survey* and the *2006 Family Income and Expenditure Survey* in the Philippines and reports basic statistics. Several types of adult equivalence scale are introduced in order to test the changes in the values of the Gini coefficient when the definition of the adult equivalence scale is different. We report the degree of inequality in Vietnam and in the Philippines using the Gini coefficient. We also calculate two kinds of inequality measures, namely the Gini index including and excluding in-kind consumption.

Section 3 considers poverty in Vietnam and in the Philippines from the perspective of the Engel curves. We report the shape of Engel curves utilizing non-parametric and

parametric approaches. Section 4 considers the role of in-kind consumption in developing countries. And section 5 evaluates the results obtained by analysis of Tanzania (cf. Maki and Kamwe (2012)), Vietnam and the Philippines. Finally in section 6 we summarize the empirical results and evaluate policy implications.

2. Data used for empirical analysis of consumer behavior in Vietnam and in the Philippines

2.1 Data source

In the present analysis we use the micro-data set of the *2006 Vietnam Household Living Standards Survey* compiled by the Statistics Bureau in Vietnam and the 2006 *Family Income and Expenditure Survey* compiled by the National Statistical Office of the Philippines. The surveys reported consumption expenditures for commodities and services, household characteristics such as number of household members, their ages, their occupation, and household income, assets and liabilities in addition to other social and economic information such as the distance of households from a medical center. We selected the following categories included in the survey data for the present analysis in Vietnam and in the Philippines: number of household members, household characteristics of household members, amount of food expenditure for a household, amount of in-kind food expenditure for a household, amount of non-food expenditure for a household and amount of in-kind non-food expenditure for a household. Utilizing such data, we calculate Engel's coefficient in two cases, namely including and excluding in-kind consumption.

2.2 Basic statistics

We present some basic statistics drawn from the *2006 Household Living Standards Survey* in Vietnam in Tables 1a and 1b.

Table 1a Basic Statistics from the *2006 Household Living Standards Survey* in Vietnam (per household, number of observations: 9,189; monetary unit: thousand dong)

Variable	Mean	Std. Dev	Min	Max
Amount of consumption expenditure				
Food	11109	6925	600	114505
Non-food	17588	36848	236	1238492
Total expenditure	28697	39832	1179	1277234
In-kind food	2166	2276	0	18635
In-kind non-food	328	770	0	49612

4

Food(excluding in-kind)	8943	7330	0	109565
Non-food (excluding in-kind)	17259	36823	0	1238492
Engel's coefficient				
Engel	.488	.159	.017	.944
Engel (excluding in-kind)	.422	.161	0	.943

In Vietnam, the number of households in the Survey is less than ten thousand in a total population of nearly eighty-seven million. The monetary unit in Vietnam is the dong. Average total household expenditure in 2006 was 28,697 thousand dong, about US\$1,794 (the 2006 exchange rate was US\$1 = 15,994.25 dong). Regarding food expenditure, the average monthly amount for all households is 11,109 thousand dong including 2,166 thousand dong for in-kind food consumption, indicating 20 percent of food expenditure is from in-kind food consumption. However, regarding the distribution of in-kind food expenditure by income class, we find that it is concentrated in poor households as indicated in Table 9a in the latter section. The overall percentage of in-kind non-food consumption is less than 2 percent, indicating that it is relatively small compared to in-kind food expenditure of 20 percent.

Below we present some basic statistics for very poor households in Vietnam as indicated in Table 1b. In the present analysis, very poor households refer to the bottom five rungs of the 20 income classes.

Table 1b Basic Statistics from the *2006 Household Living Standards Survey* in Vietnam focusing on very poor households (per household, Observations: 2,297; monetary unit: thousand dong)

Variable	Mean	Std. Dev	Min	Max
Amount of consumption expenditure				
Food	7006	2981	600	23633
Non-food	4620	2584	236	19582
Total expenditure	11627	4843	1179	39772
In-kind food	2949	2324	0	14674
In-kind non-food	445	475	0	5760
Food(excluding in-kind)	4057	2631	0	18758

5

Non-food (excluding in-kind)	4174	2554	0	18788
Engel's coefficient				
Engel	.612	.107	.233	.944
Engel (excluding in-kind)	.493	.147	0	.943

The average of total household consumption expenditure for the poorest 25 percent of all households in 2006 was 11,627 thousand dong, about US$726. In very poor households in Vietnam, 42 percent of food consumption is obtained by in-kind food consumption. We find that the share of in-kind food consumption is relatively large among the lower income classes while as total expenditure increases the share of in-kind food consumption sharply decreases.

Next, we present the basic statistics of the *2006 Family Income and Expenditure Survey* in the Philippines in Tables 1c and 1d. The number of households in the Survey is more than thirty-eight thousand. The monetary unit in the Philippines is the Philippines peso (PHP). The average of total household expenditure in 2006 was 138,892 PHP, meaning US$ 2,707 (the 2006 exchange rate was US$1= 51.314 PHP). Regarding food expenditure, the average monthly amount for all households is 58,216 PHP including 4,710 PHP for in-kind food consumption, indicating 8 percent of food expenditure is from in-kind food consumption. However, regarding the distribution of in-kind food expenditure by income level, the amount of in-kind food expenditure is concentrated among poor households. On the other hand, the overall percentage of in-kind non-food consumption is about 25 percent, indicating that it is relatively large compared to the in-kind food expenditure of 8 percent. We speculate that this is due to the different stages of economic development between Vietnam and the Philippines. When the stage of economic development is low, the weight of in-kind consumption for food is larger in order to maintain basic subsistence.

Table 1c Basic Statistics of the *2006 Family Income and Expenditure Survey* in the Philippines (per household, number of observation: 38,483; monetary unit: Philippine peso)

Variable	Mean	Std. Dev	Min	Max
Amount of consumption expenditure				
Food	58216	38298	0	801142

Non-food	80676	113386	1250	3687796
Total expenditure	138892	143124	4111	4242148
In-kind food	4710	6521	0	278392
In-kind non-food	20476	34836	0	1263634
Food(excluding in-kind)	53505	39223	0	801042
Non-food (excluding in-kind)	60199	91511	0	3387796
Engel's coefficient				
Engel	.504	.144	0	.936
Engel (excluding in-kind)	.559	.150	0	1

Table 1d denotes basic statistics for very poor households in the Philippines. The definition of very poor households is the lowest 25 percent of households in terms of total expenditure.

The average of total household expenditure in 2006 was 57,585 PHP, about US$ 1,122. In very poor households in the Philippines, 18 percent of food consumption is obtained by in-kind food consumption. The tendency for the share of in-kind food expenditure being larger in the poorer households is similar to the situation in Vietnam.

Table 1d Basic Statistics of the *2006 Family Income and Expenditure Survey* in the Philippines focusing on the very poor households (per household, number of observations: 9,633; monetary unit: Philippine peso)

Variable	Mean	Std. Dev	Min	Max
Amount of consumption expenditure				
Food	35959	13939	0	174220
Non-food	21626	10793	1420	163204
Total expenditure	57585	22273	4111	337424
In-kind Food	6575	6338	0	57223
In-kind non-food	6949	4252	0	54400
Food(excluding in-kind)	29384	13649	0	172074
Non-food(Excluding in-kind)	14676	8564	0	138779
Engel's coefficient				
Engel	0.630	0.086	0	0.891
Engel (excluding in-kind)	0.669	0.098	0	0.937

2.3 Equivalence scale

Food and non-food consumption for households are transformed into an individual basis using an adult equivalence scale. Regarding the topic of adult equivalence scale, Prais and Houthakker (1955, page 126) noted that:

"The method of measuring household size by scales of equivalent-adults, man-values or unit-consumers (which is the terminology adopted here) consists in regarding a child, say, as equivalent to a fraction of a man. This method was already used by Engel who labeled the unit a *quet* after the Belgian statistician Quetelet (*in piam memorium*) who had so much influenced his attitude to quantitative research in his youth. The main problem is, of course, what are the appropriate fractions for each type of person and how they are to be determined.

Very many scales have been proposed, and there is a considerable literature and a variety of opinions on the subject. Some hold that the phenomena are too complicated to be treated by the simple device of a scale of equivalences and conclude that the problem is more or less insoluble, as Allen (1942), or that is requires a much more intensive investigation in which the device of a scale of equivalences is unnecessary and possibly midleading."

The information of household characteristics is used to calculate an adult equivalence scale. Some of the most commonly used scales include [2]:

1) Per capita scale: All members of a household have the same weight so there is no adjustment for age and sex.

2) Oxford equivalence scale (Oxford scale in Table 2): This assigns a value of 1 to the first household member, of 0.7 to each additional adult and of 0.5 to each child.

3) OECD-modified scale (OECD scale in Table 2): In the late 1990s the Statistical Office for the European Union (EUROSTAT) modified the Oxford equivalence scale that was used widely in the 1980s and early 1990s. This scale assigns a value of 1 to the household head, 0.5 to each additional adult member and 0.3 to each child.

4) Square root scale: Recent OECD publications comparing income inequality and poverty across countries use a scale which divides household income by the square root of household size.

Let us show the difference of the adult equivalence scale in a typical household including: (1) husband, wife and two children, and (2) husband, wife, their aged parent(s)

and two children.

Table 2 Differences of the value between adult equivalence scales

(1) Husband, wife and two children

	Husband	Wife	Child 1	Child 2	total
Per capita	1	1	1	1	4
Oxford	1	0.7	0.5	0.5	2.7
OECD	1	0.5	0.3	0.3	2.1
Square root	1	0.414	0.317	0.267	2

(2) Husband, wife, their aged parent(s) and two children

	Husband	Wife	Child 1	Child 2	Parent	total
Per capita	1	1	1	1	1	5
Oxford	1	0.7	0.5	0.5	0.7	3.4
OECD	1	0.5	0.3	0.3	0.5	2.6
Square root	1	0.414	0.317	0.267	0.236	2.236

It is true that different definitions of the adult equivalence scale produce different figures and interpretations regarding household consumption, sowing confusion about the actual state of affairs. But when the transformation is applied to all the households uniformly according to the same definition to obtain an index measuring inequality of income distribution in a society, there is little difference between the different definitions. As indicated in Table 2 (1), the value is different depending on the definition of the adult equivalence scale, namely 4 for per capita, 2.7 for the Oxford definition, 2.1 for the OECD definition and 2 for the square root definition. However, when the defined figure is used uniformly for all the households, the inequality index such as the Gini coefficient does not fluctuate as a whole.

We explain the difference of income inequality applying different definitions of the adult equivalence scale. The degree of income inequality in a society is often measured by the Gini coefficient. The range of the Gini coefficient is between zero and unity. When the value is zero, the society is egalitarian because household income is equal for every household within a society. The higher the value of the Gini coefficient, the greater are disparities in a society. We calculated a preliminary adult equivalence scale using the above four definitions and adjusted total expenditure applying the four different types of adult

equivalence scales. Table 3 indicates the changes in the Gini coefficient including and excluding in-kind consumption in Vietnam.

Table 3 Gini coefficient using different definitions of the adult equivalence scale

	Including in-kind consumption	Excluding in-kind consumption
Household base	0.430	0.479
Per capita	0.433	0.484
Oxford scale	0.420	0.472
OECD scale	0.415	0.468
Square root scale	0.418	0.470

Including in-kind consumption produces a lower Gini coefficient (about 0.42) than in the case of excluding in-kind consumption (about 0.47). Thus, in-kind consumption has a redistribution effect and demonstrates the value of mutual help within communities that prevails in developing countries.

The difference of the value of the Gini coefficient according to the different definitions of calculating the adult equivalence scale within the same category such as including in-kind consumption or excluding in-kind consumption is not large, meaning that the different methods make little difference from the standpoint of economic policy regarding inequality. Therefore, we will use the per capita basis to calculate household food and non-food consumption.

One of the purposes of the present analysis is to find out whether or not the Engel curve is downward sloping monotonically. We compare the consumption behavior among three different stages of economic growth; Tanzania, Vietnam and the Philippines. In the *Household Budget Survey* in Tanzania we found an inverse U-shaped Engel curve (see Chapter **). As total expenditure increases in the very poor households, the Engel's coefficient increases, and the value reaches a peak within the range of income for very poor households, and then decreases monotonically. Because of the inverse U-shaped Engel curve, income elasticity for the food category is elastic in the very poor households in Tanzania. [3]

In this section we check the tendency of the Engel's coefficient in Vietnam and in the Philippines, particularly that of households at the bottom quartile of households, dividing the households into 20 income classes. We analyze, in a subsequent section, the differences in the value of the Engel's coefficient in each income class. We divide the

whole population into 20 income classes (refer to appendix in the paper) and the lowest quartile income class into 20 income classes in order to observe the movement of the Engel's coefficient in the very poor households. The Engel's coefficients of very poor households are summarized in Tables 4b in Vietnam and 4d in the Philippines. [4]

　　Table 4b indicates the tendency of the Engel's coefficient at the bottom quartile of all the households in Vietnam including and excluding in-kind consumption. The very poor households are divided into 20 income classes. Each cell includes 1.25 percent of total households in the survey. Regarding the Engel's coefficient the underlined figures show that the Engel's coefficient is larger than that in the previous income class, meaning that the Engel curve of the adjacent two classes is upward sloping. The Engel's coefficient including in-kind consumption increases at the income class between 3 and 4, 4 and 5, 6 and 7, 13 and 14, and 15 and 16, while that excluding in-kind consumption increases between 3 and 4, 4 and 5, 6 and 7, 7 and 8, 10 and 11, 11 and 12, 13 and 14, and 15 and 16. This indicates that the increasing tendency is observed in 6 out of 20 income classes including in-kind consumption and 8 out of 20 income classes excluding in-kind consumption. Though the Engel's coefficient decreases monotonically for all households in Vietnam, we can observe an upward fluctuation of the Engel's coefficient when we focus on the very poor households.

Table 4b Engel's coefficient including and excluding in-kind consumption: Very poor households in Vietnam (per capita, thousand dong)

income class	Expenditure					Engel's coefficient	
	Observations	Mean	Std. Dev	Min	Max	Including in-kind	Excluding in-kind
1	114	1199	187	611	1429	0.693	0.534
2	115	1554	68	1432	1660	0.670	0.519
3	115	1737	44	1661	1816	0.644	0.502
4	115	1886	32	1819	1942	0.646☆	0.505☆
5	115	2003	36	1943	2059	0.649☆	0.522☆
6	115	2121	34	2059	2173	0.636	0.483
7	114	2223	31	2174	2281	0.638☆	0.492☆
8	115	2330	28	2283	2379	0.624	0.503☆
9	115	2422	25	2379	2465	0.619	0.500
10	115	2511	27	2465	2555	0.602	0.479
11	115	2602	27	2556	2646	0.596	0.484☆

12	115	2679	21	2647	2721	0.605$^{☆}$	0.491$^{☆}$
13	115	2761	24	2722	2802	0.580	0.475
14	114	2839	21	2803	2878	0.591$^{☆}$	0.495$^{☆}$
15	115	2916	20	2879	2952	0.581	0.475
16	115	2993	22	2952	3031	0.593$^{☆}$	0.497$^{☆}$
17	113	3063	19	3031	3097	0.589	0.488
18	117	3132	20	3098	3165	0.579	0.482
19	115	3208	24	3166	3248	0.572	0.473
20	115	3288	22	3248	3326	0.556	0.463

Note: The two columns in the right-side hand indicate the movement of Engel's coefficient classified into 20 income classes among the lowest 25 percent income class. The ☆ indicates that Engel's coefficient of the current class is larger than that of the previous income class.

The tendency of the movement of the Engel's coefficient in the Philippines is the same as in Vietnam. When we focus on the tendency of the lowest 25 percent income class, we observed an upward sloping Engel's coefficient in 3 out of 20 income classes in the case of including in-kind consumption, and 4 out of 20 income classes in case of excluding in-kind consumption as indicated in Table 4d. Though the Engel's coefficient decreases monotonically for all the households in the Philippines indicated in Table 4c in the appendix, we also observed an upward tendency of the Engel's coefficient when we focus on very poor households.

Table 4d Engel's coefficient including and excluding in-kind consumption: Very poor households in the Philippines (per capita, PHP)

Income class	Expenditure					Engel's coefficient	
	Observation	Mean	Std. Dev	Min	Max	Including in-kind	Excluding in-kind
1	481	497	74	205	585	0.692	0.706
2	482	629	23	585	667	0.673	0.706
3	481	700	17	667	730	0.667	0.700
4	482	756	15	730	782	0.662	0.694
5	482	805	13	782	828	0.650	0.683
6	481	847	11	828	866	0.642	0.680
7	482	886	11	866	904	0.640	0.675
8	482	922	9	904	938	0.635	0.678$^{☆}$
9	481	955	9	938	972	0.636$^{☆}$	0.680$^{☆}$

10	482	990	9	972	1006	0.626	0.669
11	482	1023	9	1006	1040	0.622	0.662
12	481	1056	9	1040	1073	0.619	0.663[☆]
13	482	1089	9	1073	1107	0.621[☆]	0.660
14	482	1123	9	1107	1141	0.609	0.651
15	481	1156	8	1141	1171	0.606	0.653[☆]
16	482	1188	10	1171	1205	0.594	0.639
17	482	1220	8	1205	1235	0.614[☆]	0.659[☆]
18	481	1253	10	1235	1271	0.607	0.653
19	482	1287	9	1271	1302	0.595	0.642
20	482	1319	9	1302	1334	0.598	0.642

2.4 Inequality

To reiterate, the degree of income inequality in a society is often measured by the Gini coefficient. The range of the Gini coefficient is between zero and unity. The higher the value of the Gini coefficient, the greater are disparities in a society.

Especially regarding inequality, the role of in-kind consumption is important in policy evaluation. This is because in-kind consumption has a redistribution effect in developing countries. Table 5 indicates the changes in the Gini coefficient including and excluding in-kind consumption.

Table 5 Gini coefficient including and excluding in-kind consumption (per capita)

		Including in-kind consumption	Excluding in-kind consumption
Vietnam 2006	Total expenditure	0.433	0.484
	food	0.287	0.395
	non-food	0.561	0.572
Philippines 2006	Total expenditure	0.456	0.471
	food	0.322	0.363
	non-food	0.566	0.589

Usually the Gini coefficient is applied to check the degree of income inequality in a society. In addition to the usual method regarding income inequality among households, we calculated the degree of inequality for the distribution of food and of non-food items among the households. The Gini coefficient including in-kind consumption is 0.433 in Vietnam and that excluding in-kind consumption is 0.484. The Gini coefficient including in-kind

consumption is 0.456 in the Philippines and that excluding in-kind consumption is 0.471, indicating that the value of the Gini coefficient including in-kind consumption is lower than that excluding in-kind consumption. Including in-kind consumption produces a lower Gini coefficient in both Vietnam and in the Philippines. Thus, in-kind consumption has a redistribution effect in developing countries.

In order to check the characteristics of the food category, we applied the Gini coefficient to the distribution of food expenditure for all households. According to the increase in the amount of income, dietary consumption patterns shift from cereals and vegetables to cereals, vegetables and meats. We also checked for inequality in consumption by measuring the variety of food in the diet according to the Gini coefficient. When the value is zero, all the households consume the same kind of food regardless of income level. As the value of the Gini coefficient rises, the share of subsidiary food increases and so the number of dishes increases. The Gini coefficient for food in Vietnam including in-kind consumption is 0.287 and that for food excluding in-kind consumption is 0.395. The Gini coefficient for food in the Philippines including in-kind consumption is 0.322 and that for food excluding in-kind consumption is 0.363. Observing the value for the Gini coefficient of food, the variety of dishes is small compared with other categories, indicating that people consume similar meals (food category) across income classes.

We checked the Gini coefficient for the non-food category. As non-food category includes not only necessities, but also luxury goods and services, the value of the Gini coefficient is large compared to food consumption. The value of the Gini coefficient for non-food items in Vietnam including in-kind consumption is 0.561 and that excluding in-kind consumption is 0.572 whereas the value of the Gini coefficient for non-food items in the Philippines including in-kind consumption is 0.566 and that excluding in-kind consumption is 0.589. In comparing the values for Vietnam and the Philippines, we found that the degree of inequality is larger for non-food than for food categories in both countries. This is due to the effect of increasing the weight for purchasing luxury goods according to increases in income.

3. Engel curves in Vietnam and in the Philippines
3.1 Nonparametric regression

One of the enduring truths in economics is Engel's Law; i.e. the ratio between food expenditure and income (or total expenditure) decreases as income (or total expenditure)

14

increases. We test whether or not the downward sloping tendency of the Engel's coefficient is evident in Vietnam and in the Philippines. First, we conducted non-parametric regression estimation.

According to Greene (2009), nonparametric regression is defined as:

$$y = \mu(x) + \varepsilon$$

where y is a dependent variable and x is a single independent variable. A conditional mean estimating function is defined as,

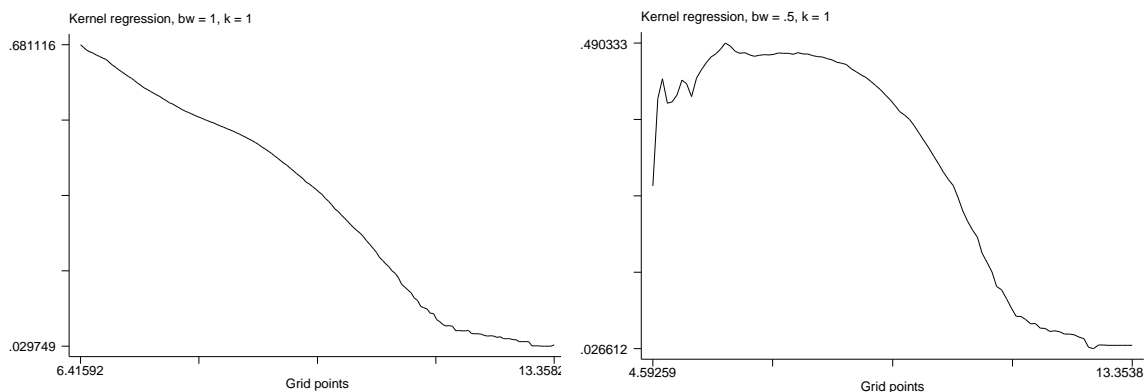$$\hat{\mu}(x^*) = \sum w_i (x^* \mid x_1, \ldots, x_n)y_i$$

where the weights sum to unity. The kernel weighted regression method is a standard tool in nonparametric analysis,

$$\hat{\mu}(x^* \mid X, h) = \{\sum (1/n) K[(x_i - x^*)/h]y_i\}/\{\sum(1/n) K[(x_i - x^*)/h]$$
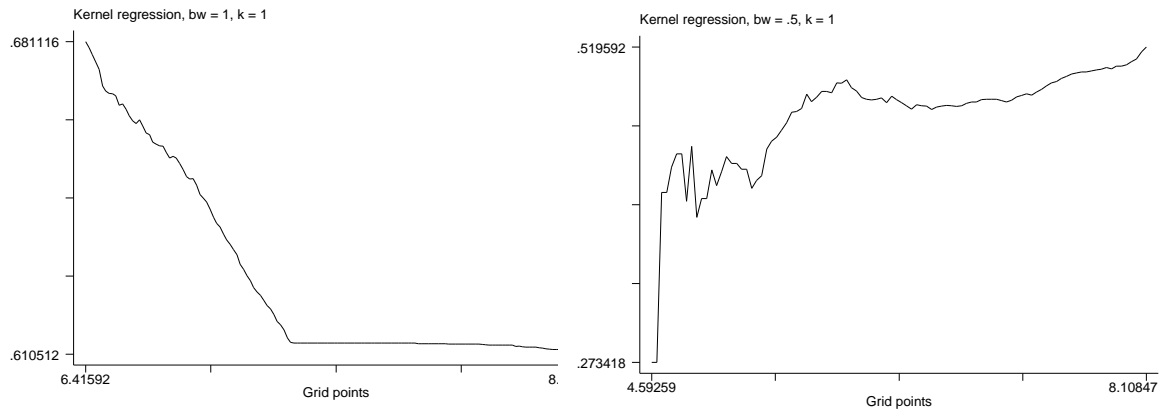
where $K[(x_i - x^*)/h]$ is the kernel density.

The Engel curves including and excluding in-kind consumption are obtained graphically as indicated in Figures 1a through 1d.

Figure 1a All households in Vietnam

left: including in-kind (refer Table 6a) right: excluding in-kind (refer Table 7a)

Figure 1b Very poor households in Vietnam (The lowest 25%)

Kernel regression, bw = 1, k = 1

.681116

.610512

6.41592   Grid points   8.

Kernel regression, bw = .5, k = 1

.519592

.273418

4.59259   Grid points   8.10847

left: including in-kind   right: excluding in-kind

Figure 1c All households in the Philippines

Kernel regression, bw = 1, k = 1

.696205

.10983

5.32569   Grid points   11.95

Kernel regression, bw = .5, k = 1

.675047

.134044

2.30259   Grid points   11.5144
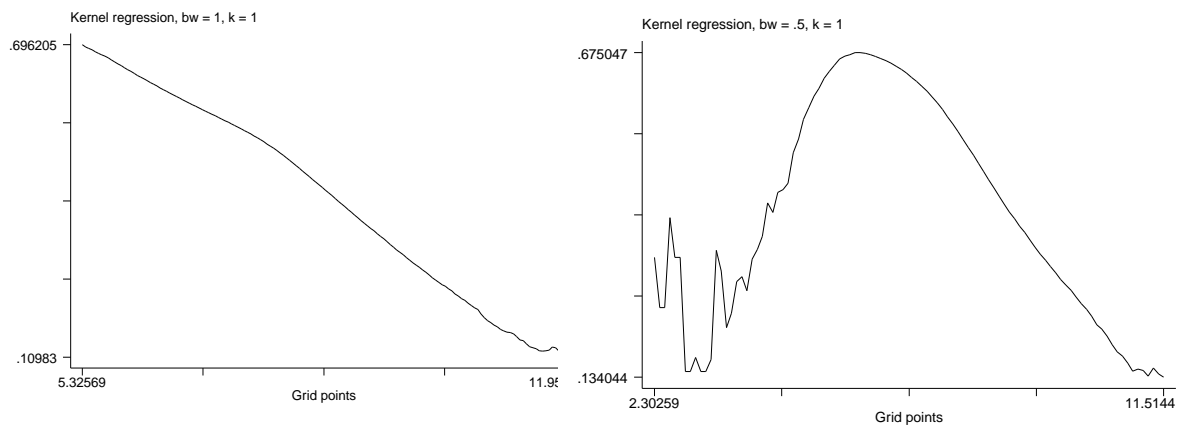
left: including in-kind (refer Table 6b) right: excluding in-kind (refer Table 7b)

16

Figure 1d Very poor households in the Philippines (The lowest 25% households)
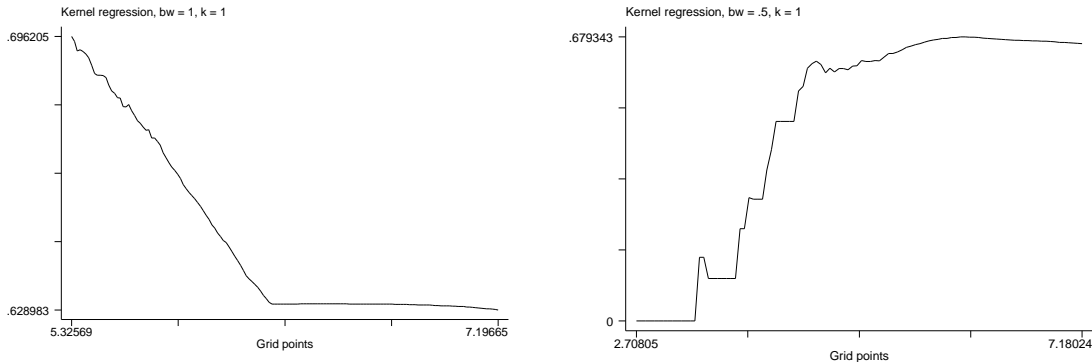
left: including in-kind   right: excluding in-kind

We observe the figures derived by nonparametric regression for the cases of Vietnam and the Philippines. As in Figures 1a and 1c, the Engel curves do not have a hump in the cases of including in-kind consumption. In Figures 1b and 1d excluding in-kind consumption, the Engel's coefficient increases as income increases, indicating cash-based food consumption is something of a luxury good in poor households.

3.2 QUAID system including in-kind consumption

We specify QUAID (quadratic almost ideal demand)-type Engel curves and test the validity of the model. [6] We estimate the Engel curves parametrically based on utility maximizing behavior for households. We specify the QUAID system in the PIGLOG type utility class.

Banks, Blundell and Lewbel (2002) proposed the QUAID system. The specification of the QUAID system food share equation is:

$$w_i = a + b \ln x_i + c (\ln x_i)^2$$

where w_i is food share for i-th household, and a, b and c are parameters to be estimated. The income elasticity of demand for food, η, in the QUAID system is:

$$\eta = ((a + b)+ (b+2*c) \ln x_i + c (\ln x_i)^2) / w_i$$

When the parameter, c, is negative, the quadratic form has a maximum value regarding the food share, w^*, at the point of the income level of $\ln x_i = -b/(2*c)$, and the maximum share

17

is:

$$w^* = a - b^2/(4*c)$$

We also calculate the effective range of income for the estimated QUAID system between $x_{min} = \exp((- b + \sqrt{(b^2 - 4*ac)})/(2*c))$ and $x_{max} = \exp((- b - \sqrt{(b^2 - 4*ac)})/(2*c))$, respectively.

When the regression coefficient of the quadratic term on income, namely c in the model, is zero, the QUAID system is ascribed to the almost ideal demand (AID) system proposed by Deaton and Muellbauer (1980).

In the present analysis, we divide total expenditure into two clusters of items, namely food and non-food expenditures. Because of Walras' Law, there is only one estimating equation in the two-commodity classification.

The estimating food share equation for the specification of the QUAID system is:

$$w_i = a + b \ln x_i + c (\ln x_i)^2 + \varepsilon_i$$

where w_i is food share for the i-th household and x_i is the income adjusted by the adult equivalence scale and ε_i is stochastic disturbance with the characteristics of i.i.d normal.

The QUAID system food share functions are estimated by the OLS and quantile regression methods. The criterion of the OLS estimation method is:

$$\min [(y – X\beta)`(y – X\beta)]$$

where y is column vector of order N, X is N by K matrix and β is column vector of order K. According to Koenker and Barett (1978) the θ-th quantile regression, $0 < \theta < 1$, is defined as any solution to the minimization problem:

$$\min [\theta | 1_N (y – X\beta) | + (1-\theta) | 1_N(y – X\beta) |]$$

where 1_N is the N-th order raw vector whose elements are unity. As the special case for quantile regression, the least absolute error estimator is the same as that derived from the median regression, namely the case of $\theta = 0.5$ in the quantile regression.

Quantile regression problem is reformulated as a linear programming technique by introducing slack vectors of u and v:

$$\min [\theta 1_N u + (1-\theta) 1_N v | X\beta + u – v = y]$$

The estimates, β, are obtained by solving the linear programming model.

We estimated the QUAID system. The estimation results of the QUAID system food share function including in-kind consumption are reported in Table 6a for the OLS regression and the quantile regression for the three cases, namely the first quantile (Q_1), the second quantile (Median) and the third quantile (Q_3).

Table 6a Estimation results: the QUAID system food share function in Vietnam (Including in-kind consumption)

	OLS	Quantile		
		Q_1	median	Q_3
a (intercept)	1.899 (17.2)	2.46 (15.9)	1.881 (13.1)	1.577 (11.0)
B	-.173 (-6.9)	-.308 (-8.8)	-.160 (-4.9)	-.086 (-2.7)
C	.001$^{☆}$ (0.7)	.007$^{☆}$ (4.0)	-.000$^{☆}$ (-0.1)	-.003$^{☆}$ (-1.9)
R^2	0.460	0.303	0.267	0.228
Note: t-value is indicated in parenthesis.				

Remark: ☆ indicates that the parameter is not statistically different from zero and/or it does not satisfy theoretical restrictions in economic theory.

The parameter c of OLS and of the 1st quantile (Q_1) regressions are positive, meaning Engel curves are not inverse U-shaped, while that of median and 3rd quantile (Q_3) regressions are not statistically significant at the significance level of 0.05. Table 6b indicates the estimation results in the Philippines.

Table 6b Estimation results: the QUAID system food share function in the Philippines (Including in-kind consumption)

	OLS	Quantile		
		Q_1	Median	Q_3
a (intercept)	1.529 (41.8)	1.853 (40.1)	1.558 (30.8)	1.263 (23.0)
B	-.122 (-13.3)	-.215 (-18.7)	-.126 (-9.9)	-.040 (-2.9)
C	-.001 (-2.0)	.004$^{☆}$ (6.1)	-.001$^{☆}$ (-1.4)	-.006 (-7.1)
R^2	0.575	0.391	0.369	0.322
Note: t-value is indicated in parenthesis.				

Regarding the parameter of the quadratic term, c, the t-value is low and it isn't different from zero statistically, indicating the Engel curve is not a quadratic form, but rather a linear form. Though the coefficient of the quadratic term is statistically significant in the case of first quantile (Q_1) regression in Table 6b, the sign of the quadratic term is

positive, indicating the Engel curve is U-shaped, but not inverse U-shaped. This result is meaningless as an empirical result because the Engel's coefficient becomes larger when income level increases even in non-poor households, contradicting theoretical expectations of a downward sloping Engel curve.

3.3 QUAID system excluding in-kind consumption

Tables 7a and 7b indicate the estimation results of the QUAID system food share function excluding in-kind consumption in Vietnam and in the Philippines.

Table 7a Estimation results: the QUAID system food share function in Vietnam (excluding in-kind consumption)

	OLS	Quantile		
		Q_1	Median	Q_3
a (intercept)	-.641	-.653	-.764	-.821
	(-7.3)	(-4.7)	(-5.8)	(-6.2)
B	.322	.303	.356	.394
	(15.7)	(9.3)	(10.9)	(12.5)
C	-.023	-.022	-.025	-.027
	(-7.3)	(-11.6)	(-12.6)	(-14.5)
R^2	0.165	0.101	0.083	0.073
Note: t-value is indicated in parenthesis. w_j has maximum value .485 at the point where income= 4515 thousand dong. Minimum income is 11 thousand dong and maximum income is 105386 dong, respectively.				

Table 7b Estimation results: the QUAID system food share function in the Philippines (excluding in-kind consumption)

	OLS	Quantile		
		Q_1	Median	Q_3
a (intercept)	-.025	.103	.212	.233
	(-0.8)	(2.3)	(5.6)	(6.0)
B	.270	.227	.217	.224
	(32.3)	(19.4)	(21.8)	(22.2)
C	-.025	-.023	-.022	-.022
	(-46.4)	(-30.2)	(-34.4)	(-34.1)
R^2	0.448	0.295	0.284	0.244
Note: t-value is indicated in parenthesis. w_j has maximum value .696 at the point where income is 5 PHP. Minimum income is 1 PHP and maximum income is 39536 PHP, respectively.				

The results from including and excluding in-kind food are very different. The regression coefficient of the quadratic term is negative in the case of excluding in-kind consumption and is statistically significant from zero, indicating that the Engel curve is inverse U-shaped. This observation satisfies Engel's Law on the right-hand side of the income level that indicates the highest Engel's coefficient.

Table 8a reports the income elasticity of demand in Vietnam at different income levels from 500 thousand dong up to 10,000 thousand dong including in-kind consumption. Table 8b indicates the income elasticity of demand in the Philippines. When we calculated income elasticity for the downward sloping Engel curve, income elasticity of demand is inelastic and the value is less than unity. When we calculated income elasticity excluding in-kind consumption, we observed income elasticity that is elastic on the left-hand side of the income level that indicates the highest Engel's coefficient. This means that cash-based and in-kind food consumption have different characteristics for very poor households. [7]

Table 8a Income elasticity of demand at different income levels in Vietnam (Including in-kind transaction): the QUAID system

Income levels (thousand dong)

Income	500	1000	1500	2000	3000	5000	8000	10000
OLS	.813	.788	.769	.754	.728	.687	.636	.605
Q_1	.754	.721	.696	.675	.639	.580	.502	.452
Median	.814	.786	.765	.748	.719	.672	.612	.576
Q_3	.854	.831	.815	.802	.780	.746	.705	.680

Table 8b Income elasticity of demand at different income levels in the Philippines (Including in-kind transaction) : the QUAID system

Income levels (PHP)

Income	500	1000	1500	2000	3000	5000	8000	10000
OLS	.809	.778	.754	.734	.699	.642	.566	.517
Q_1	.762	.727	.700	.678	.639	.572	.482	.423
Median	.806	.773	.749	.728	.692	.632	.551	.499
Q_3	.846	.814	.791	.771	.738	.683	.611	.567

4. The role of in-kind transactions

Tables 9a and 9b indicate: (1) the ratio between total expenditure excluding in-kind consumption and total expenditure including in-kind consumption, (2) the ratio between in-

kind food expenditure and total expenditure, and (3) the ratio between in-kind food expenditure and in-kind total expenditure (i.e. total expenditure minus cash-based total expenditure) classified by income classes. The first indicates the weight of in-kind consumption out of total consumption. When the value is large, the weight of in-kind consumption is small, and vice versa. The second indicates the weight of in-kind food expenditure. When the value is large, households consume more in-kind food and vice versa. The third indicates the weight of in-kind food expenditure in terms of the in-kind total expenditure. When the value is large, most of in-kind consumption is for food.

In Vietnam the role of in-kind consumption monotonically decreases as total expenditure increases, as indicated in the fourth column of Table 9a. For the lowest income class (1st income class) the rate is 60 percent, meaning the weight of in-kind consumption out of total expenditure is 40 percent. And the value monotonically decreases as income level increases. At the highest income class, the share is only 2 percent for in-kind consumption. The tendency for food expenditure is the same as in the previous case. At the lowest income class about one-third of total expenditure is in-kind food, and as total expenditure increases the ratio monotonically decreases and finally at the highest income class the weight for in-kind food consumption is only 1 percent. Out of in-kind total expenditure, about 80 percent was accounted for by the in-kind food category, as indicated in the sixth column.

Table 9a The role of in-kind consumption in Vietnam (mean, per capita)

income class	Observation	Total expenditure (thousand dong)	Total Expenditure excluding in-kind / total Expenditure (1)	Food in-kind / total expenditure (2)	Food in kind / expenditure in-kind (3)
1	459	1595	0.60	0.34	0.81
5	460	3173	0.77	0.20	0.83
10	460	4816	0.86	0.12	0.84
15	459	7620	0.93	0.06	0.83
20	460	37501	0.98	0.01	0.73

In the Philippines, the role of in-kind consumption in relatively stable compared with the case of Vietnam as indicated in the fourth column of Table 9b. For the lowest income class, in-kind consumption accounts for 30 percent of total expenditure. As total expenditure increases, the weight of in-kind consumption decreases by only 10 percent, dropping to 20 percent at the highest income class. This tendency for in-kind food expenditure is different from Vietnam. At the lowest income class about 16 percent out of total expenditure is in-kind food, and as total expenditure increases the ratio monotonically decreases and finally at the highest income class there is no in-kind food consumption. In terms of in-kind total expenditure, the weight for food is relatively large in the lowest income class, constituting about 50 percent, again differing from the case in Vietnam. In the Philippines, as income increases, the ratio of in-kind food expenditure to total in-kind expenditure decreases monotonically, reaching 5% for the highest income class.

Table 9b The role of in-kind consumption in the Philippines (mean, per capita)

income class	Observation	Total expenditure (thousand dong)	Total Expenditure excluding in-kind / total Expenditure (1)	Food in-kind / total expenditure (2)	Food in kind / expenditure in-kind (3)
1	1924	645	0.71	0.16	0.50
5	1924	1269	0.76	0.10	0.37
10	1924	2063	0.79	0.06	0.26
15	1924	3636	0.82	0.02	0.12
20	1924	15798	0.79	0.00	0.05

We summarize the different tendencies of in-kind consumption in Vietnam and the Philippines in Table 9c. We attribute the difference in (1) to the different weight of in-kind food consumption in Vietnam and the Philippines. Though the weight of in-kind food consumption is large in lower-income classes in Vietnam, it decreases sharply by 40 percent with increases in total expenditure. We attribute the difference in (3) to the different weight of non-food in-kind consumption in the two countries. As the weight of food in-kind consumption is small in the Philippines, the fluctuation of the ratio is relatively large

compared to that in Vietnam.

Table 9c Summary table on the role of in-kind consumption

	Vietnam	Philippines
(1) Total expenditure excluding in-kind/ Total expenditure	(↗)	(→)
(2) Food in-kind/total expenditure	(↘)	(↘)
(3) Food in kind/total expenditure in-kind	(→)	(↘)

5. Implication

We find that there is a link between the poverty line and the degree of in-kind consumption, especially in-kind food consumption. To clarify this, we considered two poverty lines in our analysis of Tanzanian households; one is the food poverty line and the other is the basic needs poverty line. We explain the two kinds of poverty lines applied to the Tanzanian Statistics Bureau as an example.

The food poverty line is derived under the condition that the sum of calories obtained by food consumption expenditures per adult equivalence scale is 2,200 Calories per day. The level of 2,200 Calories per day is defined by the Food and Agriculture Organization (FAO) of the United Nations as the minimum necessary for survival. The food poverty line is defined as the minimum cost of consuming 2,200 Calories per day using diary-based data from the *Tanzanian Household Budget Survey* for food consumption expenditure.

To estimate the basic needs poverty line, the Tanzanian Statistics Bureau uses the diary-based data for food consumption expenditures and the recall-based data for non-food consumption expenditures. According to the Household Budget Survey report in 2000/01 (HBS 2000/01), the basic needs poverty line is obtained in the following manner. After calculating the share, say α, of the food expenditure to total food and non-food expenditures in the poorest 25 percent of all households, the basic needs poverty line is obtained as the value of the food poverty line multiplied by the reciprocal of α. As an example, let us assume that the food poverty line is Tanzanian Shilling (TS) 10,000 and the share of food

expenditure in the poorest 25 percent is 80 percent. Thus the basic needs poverty line is calculated as TS 12,500, namely 10,000*(1/0.8). [8]

There are important differences between the food and basic needs poverty lines. A presumption of the food poverty line is that without sufficient food consumption human beings cannot survive. Thus the food poverty line mainly focuses on the problem of surviving and what is the minimum subsistence amount of money (including cash and in-kind transactions) to do so. On the other hand, the basic needs poverty line considers not only just surviving, but also the standard of living in a society beyond basic food consumption. Basic needs include accommodation, educational expenses, commuting expenses and social overhead costs such as seasonal festivals and ceremonies associated with marriages, births and funerals. Covering such costs requires payment by cash or labor services to the community.

In considering social life in developing countries, we make the following observations: 1) for food consumption the role of in-kind transfer within a society is important and when a household is poor, it will obtain food through in-kind transactions. Therefore, the weight of in-kind food consumption is large at lower income levels in Vietnam and in the Philippines; 2) for non-food consumption even the poorest households need to pay for some amount of non-food expenditure for social obligations and basic needs depending on the ability to pay; and 3) therefore the non-food category features two different characteristics, namely some expenditures are basic needs while others are discretionary luxury items.

Our findings suggest that for poor households, food purchased by cash is something of a luxury item compared with food in-kind. To summarize the discussion we classify goods in four categories, namely:

Food 1: Everybody has to consume a minimum amount of food. In developing societies, people often obtain food through in-kind transactions.

Food 2: Food classified in this category is not necessarily a necessity. They obtain food through cash transactions when their income becomes large enough.

Non-food 1: Even in a developing society people have to consume non-food items that are basic necessities. In order to do so, they obtain such goods through in-kind transactions.

Non-food 2: Non-food classified in this category includes both luxuries and necessities. They obtain non-food items through cash transactions when their income

becomes large enough.

In this setting, we can classify the development stages at least into three:

stage	consumption
Stage 1 (most basic)	food 1 + non-food1
Stage 2	food 1 + food 2 + non-food1 + non-food2
Stage 3	food 2 + non-food2

In the first stage, households with very low incomes still have non-food basic needs so they rely on in-kind transactions for food while non-food expenditure is paid for by community service and in-kind transactions. In the second stage, income is enough for subsistence food requirements through in-kind transactions while additional food is bought at markets using cash. In the second stage, the income elasticity of food can be elastic. Because income increases, the households tend to purchase some luxury foods by cash. In the third stage, as income increases cash transactions prevail for both food and non-food consumption. Due to income increases, the weight of the non-food category out of total expenditure, especially luxury goods, increases while income elasticity for food decreases monotonically as income increases.

Table 10 indicates the development process based on the cases of Tanzania, Vietnam and the Philippines and we consider the possibility of the existence of inverse U-shaped Engel curves using numerical examples. We divided the period into four: I, II, III, and IV. The amount of food, non-food and total expenditure in the table is considered depending on level of economic development.

26

Table 10 Numerical example of the inverse U-shaped Engel curves

a) Numerical example

phase	I	II	III	IV	
		($\leftarrow$	Tanzania	$\rightarrow$)	
			($\leftarrow$ Vietnam and the Philippines $\rightarrow$)		
Food total	50	70	107.5	120	($\nearrow$)
Food cash		30	67.5	100	($\nearrow$)
Food in-kind		40	30	20	($\searrow$)
Non-food total	30	30	52.5	80	($\nearrow$)
Non-food cash		20	42.5	70	($\nearrow$)
Non-food in-kind		10	10	10	($\rightarrow$)
Total expenditure	80	100	150	200	
Engel coefficient(%)	67.5	70	65	60	
Total expenditure excluding in-kind		50	110	170	
Engel coefficient excluding in-kind (%)		60	61	58	

Note: Tanzania covers periods I, II and III, while Vietnam and the Philippines cover periods II, III and IV.

b) Movement of Engel's coefficient indicating inverse U-shaped Engel curves

	I	II	III	IV	
Engel coefficient	67.5	70	65	60	($\frown$)
Engel coefficient excluding in-kind		60	61	58	($\frown$)

In the Tanzanian case we observed an inverse U shaped Engel curve including in-kind consumption. Looking at the development process, Tanzania stays in the interval between I and III, meaning that Engel's coefficient reaches a maximum at the phase of II; the Engel curve is upward sloping in the left-hand side and it is downward sloping in the right-hand side of the peak. In Vietnam and the Philippines we cannot observe upward sloping Engel curve including in-kind consumption, meaning that the two countries are in phases II, III and IV. In these phases (II, III, and IV) the Engel curve is downward sloping monotonically. On the other hand, the Engel curve excluding in-kind consumption in the two countries is inverse U shaped. This is shown in Table 10b, indicating changes in Engel's coefficient excluding in-kind consumption.

The results of accumulated empirical analysis on consumer demand behavior draw on cross-sectional data and/or micro-data sets in developed countries, but not micro-data sets in developing countries. Because of this we observed downward sloping Engel curves as a stable empirical law. Based on Engel's Law, we note the following characteristics; the food category is classified as a necessary good, and thus income and price elasticity is inelastic. But in the lowest income levels among very poor households in Tanzania and the low income levels among very poor households excluding in-kind consumption in Vietnam and the Philippines, the income elasticity of food expenditure is elastic. This finding is interesting in terms of considering the policy implications of the upward sloping Engel curve among very poor households in developing countries. Therefore, in theoretical terms we have to reconsider the different characteristics between in-kind and cash consumption in the development process.

6. Concluding remarks

In the present analysis we considered the role of in-kind consumption in terms of the total consumption expenditure of households. Using Engel curves including and excluding in-kind consumption, we found that when we include in-kind consumption in consumption expenditure, the Engel curve is monotonic downward sloping in Vietnam and in the Philippines. On the other hand, when we exclude in-kind consumption from consumption categories, the Engel curve was hump-shaped. This finding is obtained by using micro-data sets in developing countries.

Contrary to Engel's Law, we find that the Engel curve is upward sloping in very poor households, meaning that food expenditures as a percentage of income increases with

income. Considering the income adjusted by the adult equivalence scale, very poor households increase their food expenditure more than the increase in income. This is because the income elasticity for very poor households is greater than unity.

We also find that there is no significant difference between the various methods for calculating the adult equivalence scale in terms of Engel curves.

Consumer behavior is well described by the specification of the QUAID system. In developing countries we have the possibility of upward sloping Engel curves when excluding in-kind consumption. In addition to the empirical findings of inverse U-shaped Engel curve in Tanzania, Vietnam and the Philippines, we raise some questions about the validity of Engel's Law that require further empirical research in developing nations. Our findings are also suggestive about the different effects of in-kind consumption depending on the stages of economic development that may be relevant in terms of economic and social policies in developing countries especially those targeting improvement in the standard of living for poor households.

Notes:

(1) Currie and Gahvari (2008) surveys the literature.

(2) In Tanzania, Statistics Bureau made its own adult equivalence scale indicated in Maki and Kamwe (2012).

(3) In the present analysis we compare the characteristics of the Engel curve in Tanzania, the Philippines and Vietnam. According to the World Development Indicators database compiled by the World Bank, the per capita GDP of Tanzania in 2007 was US$419.50, that of Vietnam in 2006 was US$730 while that of the Philippines in 2006 was US$1,349.40, enabling us to observe the changes in expenditure patterns and compare them among the countries at different stages of economic development; Vietnam's per capita GDP is nearly double Tanzania's while the Philippines is nearly double Vietnam's.

(4) As indicated in Appendix 1, the Engel curves in Vietnam and in the Philippines are downward sloping for all the households including in-kind consumption.

(5) In the appendix we reported the movement of the Engel's coefficient for all the households in Vietnam (Table 4a) and in the Philippines (Table 4c).

(6) The specification of QUAID was strongly influenced by the analysis of Tanzanian consumer behavior in Maki and Kamwe (2012). In Tanzania we observed the inverse U-shaped Engel curve including in-kind consumption and the specification of QUAID is reasonable.

(7) Kedir and Girma (2007) analyzed consumer behavior in Ethiopia using quadratic Engel curves. However, their sophisticated empirical analysis may be wrong regarding income elasticity of food expenditure; in their paper food category is classified as inferior goods, meaning that income elasticity is negative.

(8) For details about estimating the two poverty lines, refer to Maki and Kamwe (2012).

References

Allen, R.G.D. (1942), "Expenditure patterns of families of different size," in (provide full first names of editors O. Lange, F. McIntyre and Th. Yntema (eds) *Studies in Mathematical Economics* , Cambridge, UK: Cambridge University Press.

Banks, James, Richard Blundell and Arthur Lewbel (1977), "Quadratic Engel curves and consumer demand" *Review of Economics and Statistics*, *79*, 527-539.

Cameron, A. Colin and Pravin K. Trivedi (2005), *Microeconometrics: Methods and Applications*. Cambridge, UK: Cambridge University Press.

Currie, Janet and Firouz Gahvari (2008), "Transfers in Cash and In-Kind: Theory Meets the Data", *Journal of Economic Literature,* Vol. 46, No. 2 (June), pp. 333-383

Deaton, Angus and John Muellbauer (1980), "An almost ideal demand system," *American Economic Review,70,* 312-26.

Fraker, Thomas M., (1990), *Effects of Food Stamps on Food Consumption: A Review of the Literature*, Washington, DC: Mathematica Policy Research Inc.

Greene, William H. (2008), *Econometric Analysis*, New York: Pearson.

Hoynes, Hilary W. and Diane W. Schanzenbach (2009), "Consumption responses to in-kind transfers: Evidence from the introduction of the Food Stamp Program," *American Economic Journal: Applied Economics*, *1*, 109-139.

Koenker, Roger and Gilbert Bassett, Jr (1978), "Regression quantiles", *Econometrica*, 46, 33-50.

Maki, Atsushi and Mlemba Abassy Kamwe (2012),"Does Engel's Law apply to households in a developing country? Discussion paper series no 11, Tokyo International University.

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

Slesnick, Daniel T. (1996), "Consumption and poverty: How effective are in-kind transfers?" *Economic Journal*, *106*, 1527-1545.

Appendix:

Table 4a All the households in Vietnam (per capita, monetary unit: dong)

income class	Expenditure					Engel's coefficient	
	Observations	Mean	Std. Dev	Min	Max	Including in-kind	Excluding in-kind
1	459	1595	276	611	1942	0.663	0.515
2	459	2169	125	1943	2379	0.637	0.5
3	460	2554	99	2379	2721	0.605	0.488
4	459	2877	89	2722	3031	0.586	0.486
5	460	3173	86	3031	3326	0.574	0.476
6	459	3480	87	3327	3629	0.563	0.471
7	460	3779	87	3630	3935	0.538	0.452
8	459	4091	90	3936	4245	0.533	0.454
9	459	4430	108	4245	4627	0.521	0.447
10	460	4816	108	4628	5017	0.515	0.448
11	459	5238	130	5017	5470	0.493	0.44
12	460	5699	136	5471	5942	0.476	0.427
13	459	6224	181	5942	6539	0.457	0.41
14	460	6874	199	6542	7225	0.442	0.403
15	459	7620	231	7227	8022	0.437	0.402
16	460	8521	284	8024	9034	0.415	0.387
17	459	9678	400	9035	10441	0.396	0.372
18	460	11516	668	10447	12789	0.362	0.343
19	459	14984	1502	12791	18227	0.334	0.319
20	460	37501	48146	18233	633002	0.217	0.208

Table 4c All the households in the Philippines (per capita)

income class	Expenditure					Engel's coefficient	
	Obs.	Mean	Std. Dev	Min	Max	Incl in-kind	Excl in-kind
1	1924	645.9535	104.8209	205.55	782.0182	0.674	0.702
2	1924	865.0811	45.14535	782.0667	938.1583	0.642	0.679
3	1924	1006.271	38.76075	938.1714	1073.167	0.626	0.669
4	1924	1138.95	37.81634	1073.2	1204.909	0.608	0.651
5	1924	1269.426	38.04953	1204.911	1334.3	0.604	0.649
6	1924	1399.698	38.45238	1334.32	1469.2	0.584	0.633
7	1925	1540.582	42.30204	1469.22	1615.661	0.572	0.623
8	1924	1691.826	45.52773	1615.667	1774.486	0.561	0.613
9	1924	1865.141	53.49906	1774.491	1960.72	0.546	0.601
10	1924	2063.025	59.45989	1960.875	2164.747	0.531	0.587
11	1924	2280.511	66.95169	2164.92	2399.85	0.514	0.572
12	1924	2539.041	81.80834	2400.05	2680.212	0.498	0.56
13	1924	2843.592	94.39574	2680.55	3013.686	0.482	0.547
14	1925	3201.791	113.62	3013.725	3403.6	0.464	0.527
15	1924	3636.924	138.1312	3403.85	3886.8	0.437	0.5
16	1924	4201.988	184.919	3886.9	4533.04	0.418	0.483
17	1924	4943.899	249.5388	4533.133	5404.475	0.393	0.458
18	1924	6032.382	392.6258	5404.65	6757.175	0.363	0.423
19	1924	7939.81	779.1819	6757.545	9492	0.326	0.39
20	1925	15798.98	9813.734	9493	156197.8	0.256	0.319