FOOD, FUEL AND URBANIZATION IN THE PHILIPPINES

by

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Abstract

This paper reviews Philippine data on urbanization and patterns of food and household fuel consumption with the view of identifying issues for research. Studies on food consumption patterns disaggregated by socioeconomic groups and by rural-urban-metropolitan residence are relatively few. Even scarcer are studies on household fuel consumption.

The cumulation of knowledge base on food consumption patterns is hindered by the fact that available studies use different data sets, study units, categories of food items and estimation techniques, making comparisons and validation difficult. In the case of the available energy studies, more information could have been extracted from the survey data with more appropriate methods of analysis.

In view of this, a major item in the agenda is the reanalysis of existing data to derive more precise estimates of income/expenditure, price and household size elasticities which will be the critical inputs in the construction of an economic-demographic simulation model. A preliminary simulation model designed to project food and fuel requirements and to assess the implications of various policies related to the provision of food and fuel in the course of economic growth, population change and urbanization is proposed.

FOOD, FUEL AND URBANIZATION IN THE PHILIPPINES: A REVIEW OF LITERATURE AND A RESEARCH AGENDA

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Introduction

Past studies on the economic and social implications of urbanization have focused mainly on the problems of generating employment opportunities for the growing urban labor force and of providing basic services such as housing, water supply and transportation and communication for the growing urban population. The implication of urbanization on the provision of two basic items, namely, food and fuel, however, has so far not been given adequate attention.

The spatial (rural-urban) dimension of food and fuel security can be expected to become increasingly important in the course of urbanization. For one, the aggregate demand for food and fuel will be affected by changes in demand patterns and income distribution associated with the shift in population from rural to urban areas. Likewise, the change in the spatial distribution of the population will have important implications for marketing and distribution systems to minimize food and fuel disruptions. Accordingly, systematic studies are now needed to examine the implications of urbanization on food and

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fuel security. The cumulative results of these studies are expected to provide the bases for the formulation of policies and programs in the future.

This paper attempts to review existing Philippine literature an data on urbanization, patterns of food and fuel consumption and current policies and programs related to the provision of food and fuel.

This paper is organized as follows. Section 2 provides a brief description of Philippine urbanization. Section 3 examines data and analyses on food consumption patterns while Section 4 examines existing data and analyses on household fuel expenditure patterns. Section 5 briefly notes current policies related to the provision of food and fuel. Finally, Section 6 presents a research agenda a research strategy.

Urbanization in the Philippines

Urbanization refers to the rise in the proportion of the population that is urban or to the growth of urban population relative to rural population. Urbanization is usually associated with economic growth and structural change, the latter involving the shift of economic activity away from agriculture and the location of new economic activities in specific areas to take advantage of agglomeration economies. Notable studies on Philippine urbanization include those of Pernia (1976). Pernia and Paderanga (1980), Pernia, Paderanga, Hermoso and Associates (1983) and Raymundo (1983).

Salient features of Philippine urbanization can be gleaned from Tables 1 through 4 below. The level of urbanization rose from 13 percent in 1903 to 37 percent in 1980. During this eight decades, the tempo of urbanization can be characterized as being rapid from 1918 to 1948, slackening somewhat up from 1948 to 1975 and picking up speed again since 1975. The slackened tempo of urbanization from the early postwar period up to 1975 may be partly due to the sharp decline in mortality which kept the growth of rural population high in spite of large rural-urban migration.

Philippine urbanization is marked by high primacy as revealed in Table 2. In 1980, the population of Metropolitan Manila, consisting of four chartered cities and 13 municipalities had 4 times the population of the next three largest cities. The metropolitan share of national urban population is 33 percent in 1980.

The regional pattern of urbanization can be seen in Table 3 for the more recent period, 1970-1980. Metropolitan Manila stands out in bold relief against the rest of the regions having reached the 100 percent level of urbanization in 1970. The more urbanized regions of Central Luzon, Southern Tagalog, Central Visayas, Western Visayas and Southern Mindanao urbanized more rapidly during the periods 1970-75 and 1975-80 than the rest of the regions. However, during the 1975-80 period, the less urbanized and rural regions have speeded up their tempos and somehow began to move in pace with the more urbanized regions.

Table 4 shows the relationships between urbanization and selected indicators of development and structural change based on data for the most recent period compiled by Raymundo (1983). Data for earlier periods including additional development indicators are found in Pernia and Paderanga (1980).*/ The data reveal a close relation between urbanization, on the one hand, and income and industrialization on the other hand, as might be expected. We note, however, that rural regions tend to exhibit higher incomes than the less urbanized regions and have incomes not very different on the average, from the more urbanized regions. It would appear that the rich agricultural resource base in these rural regions make up for their lower levels of industrialization to keep their income levels as high as the more industrialized regions.

In sum, this cursory look at the urbanization experience in the Philippines suggest that despite of slackened tempo during the postwar years up to 1975, urbanization may be expected to speed up in the decades ahead arising from the interactions between rural fertility declines, increased rural-urban migration, and economic growth with its accompanying structural transformation.

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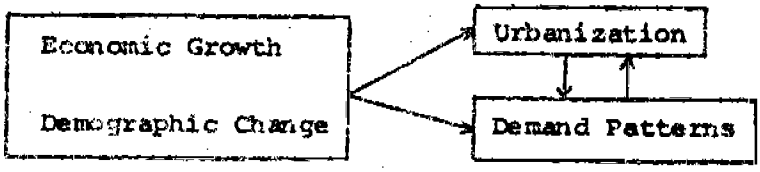
*/ The classification of regions into "More Urbanized", "Less Urbanized" and "Rural", found in Pernia and Paderanga (1980) and in Raymundo (1983) are not comparable, however.

Urbanization and the Demand for Food

General Considerations. The interrelationships between economic growth, demographic change, urbanization and changes in demand patterns are quite complex. We may, however, initially conceptualize these interrelationships in terms of the diagram below. In this framework,



the following relationships may be noted. First, urbanization and changes in demand patterns can be viewed as jointly determined by economic and demographic change. Secondly, in addition to their common determinants, urbanization and demand patterns influence each other. Examples of studies examining these relationships may be briefly mentioned.

Mohan (1982), using a dynamic general equilibrium model, examined the effect of population growth, the pattern of demand and of technological change on urbanization in the context of a low income developing country starting at a low level of urbanization. Under certain conditions, the slowing down of overall population growth, Engel-type demand changes generated by rising incomes, and appropriate technological policies tend to speed up urbanization. The specific mechanisms may be broadly described as follows. First, a slower population growth leads to a faster growth of per capita income, and with the income elasticity of demand for food being less than unity, the shift in consumption

patterns towards urban goods is correspondingly faster. This in turn increases the demand for urban labor and, consequently, higher levels of urbanization. Secondly, rising incomes and resulting Engel-type demand changes which speeds up urbanization may be reinforced by increased preference for urban goods. Finally, a shift to a more "appropriate", i.e., more labor-using urban production technology, increases the demand for urban labor, and therefore the level and rate of urbanization increase.

In another study, Kelley (1969) examined the effect of economic growth and demographic changes on the pattern of demand. Demographic changes include changes in the urban-rural distribution of the population, changes in average family size, and growth in the total number of families. Using Philippine economic-demographic experience in the early 1960s, Kelley tested a model of the following form:

$$D = f(HH, FS, RUM, E)$$

where D = total demand change (expenditure growth) on food or non-food commodities

HH = change in the number of households

FS = change in the average family size

RUM = the rate of rural-urban migration

E = growth of the mean expenditure level (which proxies for permanent income)

The empirical results of Kelley's analysis are reproduced in Table 5. With respect to the level of demand, Kelley observes:

> "...First, and not too surprising, the most important factor in the Philippines case appears to be total population growth. Second, depending upon the rate of urbanization, internal migration may, under likely circumstances, enter more importantly into demand than per family expenditure growth. Third, the combined influence of two unheralded elements in demand, internal migration and family size growth, turn out to possess a greater aggregate impact than the expansion in mean family expenditure. And finally, the combined demographic factors are overwhelmingly the crucial explanatory variable." (Kelley, 1969, p. 120)

On the composition of demand, the results suggest (column 4 Table 5) that expenditure growth and rural-urban migration serve decrease the relative allocation on food consumption each in more less the same magnitude, while total population growth is largely neutral in its specific demand compositional effect. In the aggr however, expenditure growth and rural-urban migration account for about one fourth of the total change in demand. Thus their combi effect on demand shift is neutralized by the effect of population growth.

From a p[illegible] that both rapid economic growth and a reduced population growth could combine to effect a larger shift in demand patterns away from food and towards non-food items first, by strengthening the Engel-type demand effects, and second by reducing the neutralizing effect of population growth.

As a final note, the relationship between urganization and demand patterns may be viewed from a partial equilibrium framework. Urbanization influences the aggregate level and composition of food consumption through the following mechanisms. First, given the differential urban-rural consumption patterns, a shift in population from rural to urban areas correspondingly shifts the aggregate demand for food. Secondly, changes in income distribution arising from rural-urban migration may raise aggregate demand for food faster than otherwise. Finally, changes in taste induced by an urban environment may raise aggregate elasticity for food demand. (Rogers, 1978 as cited by Pernia, 1983)

Philippine Studies on Food Consumption Patterns. National survey data on family income and expenditures conducted by the National Census and Statistics Office (formerly Bureau of Census and Statistics) reveal that food expenditures accounted for more than half of total expenditures. See Table 6. The percentage is larger (56-60) in rural than in urban areas (46-48). A declining share of food expenditures to total expenditures can be observed as one moves from rural (56-60) to other urban (48-52) and to Metropolitan Manila (40-45).

Studies on household food consumption patterns based on different household survey data have been made in the recent past. These included those of Tan and Tecson (1974), Goldman and Ranade (1976) and Canlas (1983) using the National Census and Statistics Office survey data on family income and expenditures; Aviguetero, et al. (1978) and Bennagen (1980),

using the Ministry of Agriculture survey data on food consumption; and Food and Nutrition Research Institute (1981, 1983) using their own national nutrition surveys of 1978 and 1982. Studies on rural food consumption patterns based on special area-specific surveys include those of Gonzalo (1976) which relates food consumption in terms of nutritional values, and of Mendoza (1982) which relates rice price policy on food consumption and human nutrition. Commodity-specific studies based on food consumption surveys conducted by the Department of Agricultural Economics, U.P. College of Agriculture include those of Oliva (1971) on demand for animal food; Aragon (1972) on cereal consumption patterns; and Urbino (1972) on demand for selected vegetables. In addition to these studies using household survey data, estimates of consumer demand functions, including demand for food, based on aggregative time series data on personal consumption expenditures and its components have been done by Pante (1980). Below we examine these studies in turn, with the exception of those limited only to specific areas or to specific commodities.

Using data from the NCSO's family income and expenditure surveys for the years 1957, 1961, 1965 and 1971, Tan and Tecson (1974) analyzed consumption patterns and estimated Engel curves for various expenditure items, including food. We report below some of their results.

Table 7 shows the average family expenditures for food by urban-rural area and by selected income categories. As might be expected the proportion of expenditures on food to total expenditures decline with

increasing income, even as the total value of expenditures rises. The pattern is the same for both urban and rural families, although the relative proportion are generally lower in the urban than in the rural areas.

Table 8 shows estimates of expenditure elasticities for food in general and for specific categories of food for urban and rural areas and for various survey years. Elasticities were computed from the parameters of the double log form of the equation:

$$C_{ik} = a + b E_k$$

where C_i = expenditures for food category i by income class k

E = average family expenditures in income class k

For the Philippines as a whole, expenditure elasticities for food are in the order of 0.78-0.82. For specific food items, expenditure elasticities for "Cereals" (.45-.59) are lower than either "Protein" (1.11-1.16) or "Other Food" (.98-1.21), as might be expected. Urban-rural differentials are also worth noting. For "Food", expenditure elasticities are generally lower in the urban areas (.76-.82) than in the rural areas (.87-.88). The pattern for "Cereals" vs. "Proteins" and "Other Foods" observed for the Philippines holds within urban and rural categories while urban-rural differentials are maintained between food categories.

Tan and Tecson also examined the effect of family size on the level and composition of family expenditures. The regression on food/food category expenditures using the linear form of the following equation: $C_{ik} = a + b_1 n_k + b_2 E_k$ where n_k = average family size in income group k are shown below for the period 1971 (Table 12, p. 95).

Item	a	b_1	b_2	E_1	E_2	t_1	t_2	$\bar{R}^2$
Food	347.0	170.934	.361	.210	.667	9.772	40.747	.967
Cereal	143.4	173.761	.044	.618	.236	33.552	16.862	.961
Protein	106.6	.337*	.160	.001*	.886	.036	33.671	.945
Other Food	95.5	-3.364*	.137	-.015*	.896	-.507	40.919	.962

*/ Not significant.

The inclusion of family size in the equation reduces the expenditure elasticity (at the mean) as might be expected due to the correlation between expenditures and family size. Partial size elasticity (at the mean) for food is less than the expenditure elasticity; for cereals, however, the reverse is the case. Increases in family size do not appear to be significantly related to the consumption of "Protein" or "Other Food".

To avoid multicollinearity problems, Tan and Tecson ran regressions for each size category. The results shown in Table 9 reveal increasing value of the intercept with increasing family size for "Food" and "Cereal" but no definite trend for "Protein" and "Other Food". The results are consistent with the data above where both independent variables are included in the equation.

A more recent study was conducted by Canlas (1983) using the 1965 round of the family income and expenditure survey of the NCSO. Canlas' study is noteworthy in that both income and price elasticities were estimated for four separate subsamples: Philippines, urban, Manila and rural, and for seven food groups: cereals, fish and other seafoods, meat and eggs, milk and dairy products, roots, miscellaneous, and food consumed outside. The estimation procedure essentially involves deriving a set of consumer demand systems including leisure, from an augmented Stone-Geary utility function. To estimate the resulting expenditure system (LES), the parameters of a regression model based on the leisure demand function was first estimated; these estimates are then used to estimate the parameters of the food demand functions. Table 10 presents the estimates of own price and income elasticities.

As might be expected income elasticities are lowest for Cereals and Fish and Other Seafoods and highest for Meat and Eggs, Milk and Dairy Products, and Food Consumed Outside. A decrease in income reduces consumption of the latter three food items much more greatly than the former two items -- these two items being the staple food of the average Filipino household. The pattern is similar within area categories, but income elasticities in rural areas are generally higher than in urban or Manila areas except for Roots and Food Consumed Outside. The reverse pattern is observed when we consider own price elasticities, that is, we find lowest values for the staple foods Cereals and Fish and Other Seafoods, and highest for Meat and Eggs, Milk and Dairy Products and Food Consumed Outside.

A second set of nationwide food consumption data comes from a series of quarterly surveys conducted by the Ministry of Agriculture from 1970 to 1976. The sample size for each survey is 1,000 families. Aviguetaro, et al. (1978) reports on the analysis of the pooled data from 1974-76 in terms of annual per capita consumption of specific food item by region. The report also presented income-quantity elasticities for selected items shown in Table 11. Units of analysis are households instead of grouped data as in the case of Tan and Tacson, and Canlas. The data, however, did not distinguish between urban and rural areas, although regional estimates were made.

A recent study using the pooled quarterly survey data for 1976 of the Ministry of Agriculture's food consumption survey was done by Bennagen (1980). The characteristics of the sample households by income level are summarized in Table 12. We note that the average per capita food expenditure increases with income, whereas the percent of income spent on food declines. This is consistent with what we might expect. Data on expenditure shares and average per capita consumption for major food groups by income level are shown in Table 13. Cereals account for the largest part of household expenditures for all income groups, although the percent share decline from 46 percent for low income groups to 34 percent for high income groups. Seafood accounts for the next largest share of food expenditures, maintaining its share of 16 percent in all income groups. Per capita consumption as well as percent share in total food expenditures for meat, eggs, and dairy products increase with income.

Bennagen also estimated various elasticities for major food groups based on the parameters of the following equations:

$$E_{ij} = a_{o_i} + a_{1_i} \ln Y_j + a_{2_i} \ln N_j$$

and

$$Q_{ij} = b_{o_i} + b_{1_i} \ln Y_j + b_{2_i} \ln N_j$$

where E_{ij} = weekly expenditure on the ith food item by the jth household

Q_{ij} = weekly quantity consumed of the ith food item

Y_j = total annual income of jth household

N_j = total number of household members in the jth household.

The results are shown in Table 14. Income elasticities are lowest for cereals and rootcrops and highest for red meat. Conversely, household size elasticities are highest for cereals and lowest for red meat. Table 15 shows elasticities computed separately for each income group based on the following equations:

$$E_{ij} = a_{o_i} + a_{1_i} \ln Y_j + a_{2_i} \ln N_{10_j} + a_{3_i} \ln N_{9_j}$$

and $$Q_{ij} = b_{o_i} + b_{1_i} \ln Y_j + b_{2_i} \ln N_{10_j} + b_{3_i} \ln N_{9_j}$$

where N_{10_j} = number of members in the jth household age 10 years and over

N_{9_j} = number of members in the jth household age 9 years and below

The results show that for the All Food category, the income elasticity (expenditure model) is generally lower at low income levels, and is higher at the middle income and high income levels. This might reflect the fact that an increase in income among higher income groups shifts consumption patterns towards higher priced foodstuffs more than it does among lower income groups. Size elasticity of household members age 10 years and over declines from 0.44 for low income groups to 0.38 for high income groups while size elasticity for household members less than 10 years remain at a relatively low level of 0.02 across income groups. Elasticities vary across income levels by food items, although many estimates are not significant.

A final major source of household data on consumption patterns is the nutrition surveys conducted by the Food and Nutrition Research Institute (FNRI). The Institute conducts surveys every five years to assess the nutritional status of the population. Food consumption measurements are done through precise weighing of actual one-day food intake at the household level and, therefore, differ from surveys that asks of respondents weekly consumption by food items as done by the NCSO and Ministry of Agriculture surveys. Two national surveys have been done so far. The 1978 round surveyed 2,800 households while the 1982 round covered 2,880 households; both surveys excluded Regions IX and XII. Relevant data from these surveys are briefly described below.

Table 16 shows the mean one-day per capita food consumption by major and specific food groups and by area of residence. Several observations may be made. First, the per capita consumption of cereals and starchy roots generally declines as one moves from rural to other urban and to Metro Manila areas. In contrast per capita consumption of body-building foods generally increase from rural to other urban to Metro Manila. Likewise, per capita consumption of regulating foods with the exception of green leafy and yellow vegetables generally increase with increasing level of urbanization. These differential consumption patterns by level of urbanization may be reflective of differential income levels associated with urbanization as well as by differential tastes and preferences for specific food items. The effect of income on consumption patterns may be gleaned from Table 17. We note that per capita consumption of cereal and starchy roots decline with increasing income. In contrast per capita consumption for body-building foods generally increases with income.

Differential per capita consumption of specific food stuffs by occupation of household head are shown in Table 18. Per capita cereal consumption is highest among farm-related occupations and lowest among professionals. In contrast per capita consumption of fish, meat and poultry is highest among professionals and housewives/students and lowest among farm-related occupations. These differentials may reflect not only income factors but also energy requirements related to the type of work performed.

The relative vulnerability of urban residents to food shortages arises from the fact that while rural residents can both purchase and produce food, urban residents to a large extent can only purchase such item. Data in Table 19 tend to support this observation. Rural residents produce from 22 to 31 percent of their food consumption while urban residents produce only less than 10 percent of food consumed. In Metro Manila, the percentage is only around 6 percent.

Estimates of income elasticities for specific food items reported by the FNRI are shown in Table 20. Elasticities for cereals, starchy roots and green leafy and yellow vegetables are negative implying that increases in income reduces the per capita consumption of these items. For most of the major food items, i.e., body-building foods as well as vitamin C-rich foods, the elasticities are positive. Differential elasticities by level of urbanization can be noted. Elasticities generally decline with increasing level of urbanization for fish, meat and poultry, eggs, milk, dried beans, vitamin C-rich foods. This may mean that rural and less urbanized households with generally lower incomes and generally lower levels of consumption for these items tend to increase their per capita consumption more when their incomes increase than would the more urbanized households who may already be consuming these items at higher levels. Table 21 shows the income elasticities by per capita income class. Differential patterns of income elasticities by income class can be noted.

Finally, FNRI analyzed the determinants of per capita peso value of food consumed by regressing this variable with per capita income, household composition, household size, urbanization, and education of wife. The results are shown in Table 23. The per capita income elasticity is 0.25 for all food consumed whether bought or produced at home and 0.33 for food purchased only. An increase in household size generally reduces per capita consumption, while an increase in household members age 13 years and over increases per capita consumption because of the generally heavier food requirements of adults and teenage children than young children. Urbanization tends to increase per capita consumption in value terms.

Before leaving this section, we briefly note the study by Pante (1980). Using aggregative time series data on personal consumption expenditures and its components for the period 1949 to 1974, Pante tested dynamic of demand functions for durable and non-durable consumer goods. A by-product of this exercise of interest to this study are the estimates of static demand functions for food and specific food categories. Regressing real per capita expenditure on ith commodity on real per capita total personal consumption and real price of the ith commodity, Pante obtained the following coefficients for selected commodities (standard errors in parenthesis).

	Real Per Capita Consumption	Real Price	$\bar{R}^2$	D.W.
Food**	0.990 (0.004)	-1.004 (0.008)	0.999	2.23
Cereals*	1.000 (0.0002)	-0.999 (0.003)	0.999	2.50
Meat, Meat Products and Eggs*	0.861 (0.051)	-0.174 (0.081)	0.924	1.21
Milk and Dairy Products**	0.969 (0.068)	-0.923 (0.095)	0.901	1.93
Fish and Dairy Products*	0.999 (0.001)	-0.994 (0.002)	0.999	1.74
Fruits and Vegetables**	0.951 (0.035)	0.925 (0.047)	0.969	2.16

*Double-logarithmic, untransformed equation.

**Double-logarithmic, first difference equation.

The income elasticities Pants obtained are generally higher than those obtained from household level studies. This result is due to two factors: first, the aggregate time series data are likely dominated by the behavior of lower income households whose elasticities are rather high and second, the more complicated stock adjustment process implicit in his specification captures the long-run elasticity for a developing country more completely. These results tell us that at the present time the elasticities of demand for food may continue to be very high for quite awhile as development proceeds. Pants finds a little less than unitary price elasticity for most food items with the notable exception of meat, meat products and eggs. Again these values must be interpreted as reflecting aggregate behavior.

Summary. Thus far we have briefly described the major studies on food consumption patterns in the Philippines. The studies use different data sets, estimation techniques, level of aggregation of study units and categories of food items. As such it is difficult to cumulate our knowledge base regarding patterns of food consumption or to validate one set of estimates against another. Several general observations, however, may be made from these studies, aided in part by the summary Table 23.

(1) Food expenditures still account for more than half of total household expenditures during the 1957-71 period; the percentage being highest in rural areas (56-60), lower in other urban areas (48-52), and lowest in Metropolitan Manila (40-45). These area differentials may be explained in large part by differentials in mean incomes associated with different levels of urbanization.

(2) Based on cross-section studies, the percentage of food expenditures to total expenditures do decline with increasing income from 57-69 percent for households with annual incomes under ₱500 to around 32 percent for households with annual incomes of over ₱10,000 during the 1957-71 period.

(3) While the proportion of expenditures on food to total expenditures decline with increasing income, the total value of food expenditures rises with income. In 1971, for example, average family expenditures in the income category of less than ₱500 was nearly five

times the value for the income category ₱10,000 and over (₱1,133 vs. ₱5,014), even as the proportion of food expenditures declined from 69 percent to 32 percent. Increasing income may be associated with a shift from low priced to high priced and better quality food due to changing tastes. The effect of urbanization on aggregate food demand can be inferred from the relationship between income, tastes and urbanization. If urbanization is related to increasing income levels and changing taste for higher priced (quality) food, then the total demand for food is expected to rise much faster with increasing level of urbanization than otherwise.

(4) The income/expenditure elasticity for food is less than unity, and its value is generally higher in the rural than in the urban areas.

(5) Across food types, income/expenditure elasticities are generally lower for cereals and starchy staples and higher for protein/body-building foods, vitamin C-rich foods, fruits and other vegetables. The rural-urban differential noted in (4) above generally holds. Among urban areas differentials exist between Metropolitan Manila and other urban areas, strongly suggesting the need to distinguish these two urban areas for future analysis.

(6) Own price elasticities are less than unity and are lowest for cereals (-0.258) and for fish and seafoods (-0.382), the staple food of Filipinos, and highest for meat and eggs (-0.821), milk and dairy products (-0.757) and food consumed outside (-0.926). Within food categories, differential patterns exist by rural-urban areas.

(7) Household size elasticity is generally around 0.210 when total expenditures is controlled for (Tan and Tecson) or around 0.47 when household income is controlled for (Bennagen). In general household size elasticity tend to be higher for cereals than for protein foods. When age composition is allowed for, size elasticity is higher for household members age 10 years or over. Young children do not have much impact on aggregate food consumption.

Urbanization and the Demand for Household Fuel

Data on the household demand for fuel are even scarcer than that for food. The major source of information on fuel demand is the series of surveys conducted by the Ministry of Energy (1982) since 1977.

In order to obtain baseline information on energy consumption patterns, the Ministry of Energy conducted a series of energy surveys consisting of the 1977 Survey of Urban/Rural Energy Demand, the 1979 Survey of Household Energy Consumption and Conservation Practices, the 1979 Survey of Commercial Establishments Energy Demand, and the 1979 Survey of Industrial Energy Demand. We examine below the data from the 1977 and 1979 surveys on household energy demand.

Table 24 presents data on annual household energy consumption (in BOE equivalent) by energy item in 1977. In the Philippines as a whole, non-commercial energy accounted for 56 percent of total household fuel consumption while commercial fuels accounted for the rest. Rural areas consumed non-commercial energy items in greater proportion

than urban areas (63 vs. 48 percent) as might be expected. Among the non-commercial energy items, 98 percent was accounted for by firewood (60 percent), charcoal (26 percent) and coconut shells (12 percent). On the other hand, gasoline accounted for 42 percent of commercial energy consumed, followed by kerosene (39 percent). Electricity accounted for only six percent of total commercial energy consumption.

Urban-rural differentials in energy consumption patterns are as expected. On the average, urban households generally consume more energy than rural households (10.4 vs. 4.1 BOE) and urban households tend to use commercial energy in greater proportion than rural households (52 vs. 38 percent).

Total energy consumption is expected to rise with increasing income. Unfortunately, the published data on the 1977 survey did not contain this information, i.e., per household or per capita energy consumption by income class was not computed. Table 25, however, shows differential pattern of energy consumption by income class. A shift in consumption from non-commercial to commercial energy tend to occur with rising incomes in the urban areas but not quite so for rural areas. In fact for rural areas, the proportion of non-commercial energy consumed increases with income. This may be due to the fact that a wider range of energy sources are available in the urban than in the rural areas. The implication seems to be that a shift in

population from rural to urban areas accompanied by income increases would tend to increase aggregate demand as well as shift fuel demand towards commercial energy sources.

In determining the socioeconomic correlates of energy consumption, the Ministry of Energy ran regressions relating measures of energy consumption with household size, income and price. Unfortunately, instead of using individual households, the analysts used regional aggregates as the units of observation. As a result the regression analysis shown in Table 26 is uninformative.

The 1979 energy survey conducted by the Ministry of Energy covered only Metro Manila and 12 key urban areas of the country. The survey obtained data on energy consumption of households by type of energy, by household activities and by socioeconomic class. In addition, it obtained information on energy conservation and substitution practices.

Table 27 shows the percentage of households by type of fuel used and by socioeconomic class. In an urban setting, electricity is a major source of energy. Practically all households use electricity, mainly for lighting. The proportion of households using electricity declines with decreasing incomes in the other urban areas of the country but not so in Metro Manila. The proportion of households using kerosene and wood generally declines with increasing income, mainly due to the substitution of these fuels for electricity (for

lighting) and LPG (for cooking). The use of LPG increases with rising incomes as are the use of candles and batteries. The shift from non-commercial to commercial fuel associated with higher incomes is sharper in Metro Manila than in the other urban areas.

Table 28 shows the usual sources of energy by household function. Electricity is mainly used for lighting and for the operation of electricity-dependent durables. Wood and LPG, on the other hand, are the major fuels for cooking, with higher income households tending to use LPG more than wood and conversely for low income households.

Finally, Table 29 shows the average monthly fuel expenditures by socioeconomic class. Total expenditures tend to increase with income. With respect to specific energy items, expenditures for electricity and LPG generally increase with income to a larger extent than do expenditures for wood, charcoal and other fuels. The expenditures for kerosene generally decline with income indicating a shift to electricity for lighting or to LPG for cooking by higher income households. Noteworthy is the differentials between Metro Manila and other urban areas as might be inferred from the comparison between Metro Manila alone and all urban areas including Metro Manila together.

In sum, the surveys have provided interesting empirical data on household energy consumption patterns. The surveys provide a rich source of data that have yet to be fully analyzed.

Policies on Food and Fuel Security: A Note

This section briefly describes some of the main public policy thrusts with respect to food and energy in general.

One of the objectives of agricultural policy (as contained in the Five-Year Philippine Development, 1983-1987) is to "stimulate the growth of food production with special emphasis on food products for the nutritionally at-risk and/or deprived population groups, to ensure the availability of requisite food supplies" (p. 47). To help achieve this goal, emphasis is placed on maintaining self-sufficiency in rice, fish, poultry, pork, vegetables and fruits, and in attaining self-sufficiency in corn and livestock. Various programs of crop diversification, expanded irrigation, and the use of modern technology are currently being implemented.

At the marketing side food security is to be attained through a rational price system which assures farmers of a more stable real income and to encourage private sector participation in marketing while maintaining reasonable levels for consumers. A major food commodity in which the public sector has taken active part in the production and marketing activities is palay/rice. On the production side, programs, such as the Masagana 99, which provides farmers with credit facilities as well as technical and institutional support have been implemented. In addition it maintains a floor price for palay through the active procurement activities of the National Food Authority (NFA). On the

consumption side, a ceiling price is maintained for rice by NFA's holding of an adequate buffer stock. Thus, the maintenance of a floor price for palay sufficient to induce increased production and of a price ceiling for rice to enable consumers adequate supply at reasonable prices are the major mechanisms through which food (rice) security is being attained. The success of this pricing policy obviously rest upon the effectiveness of the procurement activities on the one hand, and the maintenance of buffer stock, on the other.

With the uncertainties over energy supply and prices during the last decade, public policy has began to put greater stress on energy security. Security in supply is expected to be achieved by building up the country's energy resources capability in order to reduce dependence on imported oil. Investments have been stepped up in oil explorations. geothermal, hydroelectric and nuclear energy generations to meet future demands. It is projected, for example that the oil share in total commercial energy will fall to 68 percent in 1988 from 91 percent in 1979. Correspondingly, the share of hydro, geothermal and nuclear will increase from 7 percent in 1979 to 20 percent in 1988 (Ministry of Energy, 1979).

Research Issues/Agenda

This paper has reviewed several studies on food and household energy consumption patterns. The difficulty in cumulating our knowledge base from these studies arises from several factors.

First, the studies are based on different data sources which differ in reliability. Secondly, different measures of variables, units of analysis, levels of aggregation and analytical techniques have been used by various investigators making comparisons difficult. Additionally, in the case of the energy studies, more information could have been obtained from the basic data had more adequate (and more correct) analysis have been made.*/

In view of these methodological problems, the first item in the agenda is to reanalyze data from some of the major data sources using more appropriate and consistent methodology, and where possible, using a common level of disaggregation or categories. Methodological issues related to the analysis of food demand have been conveniently summarized by Currie (1972), while those for energy by Taylor (1977).

On more substantive aspects, several questions on food, fuel and urbanization posed by Pernia (1983) still remained unanswered by the studies reviewed in this paper. It might be useful to review some to these questions and indicate the extent to which the studies reviewed in this paper are able to provide the answers as well as the likely directions future research will take.

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*/ For example, tabulations/graphs showing aggregate consumption by income levels are not informative; what is more meaningly are tabulations/graphs showing per household or per capita energy consumption by income. Moreover, regressions could have been done using households as units of observations rather than regions.

1. What are the patterns of food and fuel consumption by metropolitan, urban and rural sectors, and by income and occupation groups in each sector; what is the composition of food consumption in terms of starchy staples and non-staples, and of fuel use in terms of traditional and non-traditional types.

While the studies described earlier do provide insights into demand patterns for food and household fuel, further analysis of the data using appropriate methodological approaches are still required. The major data sources for food demand analysis will be the NCSO surveys of family income and expenditures including the 1975 round which has so far not been analyzed, and the FNRI data for 1978 and 1982. For household fuel, the Ministry of Energy survey data for 1977 and 1979 will be used to estimate income and price elasticities by rural-urban categories.

2. What are the food and household fuel requirements due to urbanization likely to be in the next 10 or 20 years; how important will urban population growth be relative to urban economic growth as a determinant of increasing levels and changing composition of demand; in what ways would the nature of demand change if urban growth rates or concentrated urbanization were reduced?

Answers to these questions require the estimation of an economic-demographic simulation model, incorporating the types of analyses earlier done by Kelley (1969). Part of the information sets

required for this model are those that will be obtained from activity (1) above. Annex A describes a preliminary simulation model that may be useful for policy purposes.

3. What are the substitution possibilities (elasticities) among food, fuel and other consumption items in household demand functions; what are the substitution elasticities among various food and fuel types (e.g., between nutrition-intensive and taste-intensive foods and between traditional and non-traditional fuels)?

The only study which computed price elasticities of specific food items is Canlas (1983). Clearly, this area of study is needed to obtain answers to the above questions. Activity (1) described above will address these questions.

4. What are the current marketing and distribution systems and how might they be made more efficient and effective in meeting future requirements?

The activities of the National Food Authority in the procurement of palay and buffer stocking of rice have been described recently by Abenina, N.A. and R.C. Tanchanco(1984). A more in-depth study of the marketing an distribution of palay/rice including the role of the private sector might provide insights into how the marketing and distribution of other types of food and household fuel can be made more efficient.

5. To what extent do plans, policies, and programs relating to food and fuel provision respond to the changing requirements of urbanization?

This requires impact studies of various policies that directly or indirectly affect food and fuel supply as well as their distribution to various categories of households. Pricing policies (for palay and rice) for example may be further evaluated for their impact in ensuring food (rice) security in both urban and rural areas. Additionally, general macroeconomic policies affecting factor prices for agricultural inputs vis-a-vis industrial inputs might have some impact on food production itself. The studies of David (1983) in this regard would be a useful reference.

Table 1

LEVEL AND TEMPO OF URBANIZATION AND URBAN AND RURAL POPULATION: PHILIPPINES, 1903-80

Year	Urbanization		Urban Population		Rural Population	
	Level[a]	Tempo[b]	Number (thousands)	Percent Annual Growth Rate	Number (thousands)	Percent Annual Growth Rate
1903	13.1	-	1,000.2	-	6,635.2	-
1918	12.6	-0.32	1,294.2	1.64	9,020.1	1.96
1939	21.6	3.36	3,450.7	5.02	12,549.6	1.66
1948	27.0	3.09	5,183.7	4.25	14,050.5	1.16
1960	27.8	1.28	8,072.5	3.98	19,015.2	2.70
1970	32.9	1.46	12,068.8	4.02	24,615.7	2.56
1975	33.4	1.46[c]	14,046.5	3.76[c]	28,024.1	2.30[c]
1980	37.3	3.54	17,940.7	5.02	30,157.7	1.48

[a] Percent in urban places. The 1963 urban definition was used for censuses prior to 1975. The 1970 definition was applied to 1975 and 1980 censuses. If the 1970 definition is used for 1970, the level of urbanization would be 31.8 percent instead of 32.9 percent.

[b] Urban-rural growth difference.

[c] The initial 1970 urban and rural populations used are based on the 1970 definition. These are 11,677.8 and 25,006.7, respectively.

Sources: Pernia, E.M. and C.W. Paderanga, Jr. (1980; Table 1, p. 6) and Raymundo, C. (1983; Tables 4.1 and 4.2, pp. 66-67).

Table 2

INDEX OF URBAN PRIMACY: PHILIPPINES, 1903-1980

Area	1903	1939	1960	1970	1975	1980
Set A[a/]						
Small Metropolitan Area	4.03	3.57	4.27	4.26	4.43	4.40
Large Metropolitan Area	-	-	4.91	5.31	5.76	5.94
Set B[b/]						
Small Metropolitan Area	-	-	3.3	3.3	3.2	3.0
Large Metropolitan Area	-	-	-	4.2	4.3	4.1

Note: The small metropolitan area of Manila comprises the four chartered cities of Manila, Caloocan, Pasay and Quezon and the four municipalities of Makati, Mandaluyong, Navotas, and San Juan. The large metropolitan area includes the small metropolitan area as well as nine other municipalities: Malabon, Marikina, Las Piñas, Parañaque, Pateros, Pasig, Taguig, Muntinlupa, and Valenzuela.

a/ The next three largest cities used in the computation of the index are Cebu, Iloilo and Bacolod.

b/ The next three largest cities used in the computation of the index are Cebu, Davao and Basilan for 1960; Cebu, Davao and Iloilo for 1970; and Davao, Cebu and Zamboanga for 1975 and 1980.

Source: Pernia, E.M. and Paderanga, C.W. Jr. (1980, Table 2, p. 7) for Set A updated to 1980 by present authors, and Raymundo, C. (1983; Table 4.5, p. 70) for Set B.

Table 3

REGIONAL PERCENT SHARE OF TOTAL URBAN POPULATION AND URBANIZATION LEVELS AND TEMPOS: PHILIPPINES, 1970-1980

Region	Percent of Total Urban Population			Level of Urbanization			Tempo	
	1970	1975	1980	1970	1975	1980	1970-75	1975-80
Philippines	100.0	100.0	100.0	31.8	33.4	37.3	1.5	3.5
Metropolitan Manila	34.7	35.4	33.0	100.0	100.0	100.0	4.6	3.6
More Urbanized	40.3	42.1	44.0	27.3	30.0	34.9	2.7	4.7
Central Luzon	9.5	10.2	11.2	30.1	33.9	41.8	3.6	7.0
Southern Tagalog	11.6	11.8	12.6	29.8	31.8	36.9	2.0	4.7
Central Visayas	7.3	7.0	6.8	27.6	28.9	32.0	1.3	3.0
Southern Mindanao	5.1	5.2	6.2	26.6	26.7	33.5	0.1	6.9
Western Visayas	6.8	7.9	7.2	21.5	26.7	28.3	5.9	1.7
Less Urbanized	17.8	16.4	16.4	19.6	20.2	23.3	0.7	3.8
Ilocos	5.1	4.9	4.7	19.4	21.0	23.8	2.1	3.2
Bicol	5.0	4.2	4.2	19.2	18.4	21.5	-1.0	3.9
Eastern Visayas	4.1	3.5	3.4	19.4	18.7	21.8	-0.9	3.9
Northern Mindanao	3.6	3.8	4.1	20.9	23.2	26.6	2.8	3.8
Rural	7.2	6.3	6.7	15.0	14.6	17.1	-0.6	4.0
Cagayan Valley	2.1	1.8	1.9	14.1	13.4	15.5	-1.4	3.6
Western Mindanao	2.6	2.2	2.4	15.6	14.9	17.0	-1.4	3.4
Central Mindanao	2.5	2.3	2.4	14.9	15.5	18.8	0.9	4.9

Source: Raymundo, C. (1983; Table 4.7, p. 72) from various census reports.

Table 4

REGIONAL INDICATORS OF URBANIZATION AND ECONOMIC DEVELOPMENT: PHILIPPINES

Region	Level of Urbanization	Tempo	Urban Share	Median Annual Family Income (Pesos)	Share of Employment in Non-Primary Activities
	1980	1975-80	1980	1975	1978
Philippines	37.3	3.5	100.0	4,076	49.9
Metropolitan Manila	100.0	3.6	33.0	7,056	98.5
More Urbanized	34.9	4.7	44.0	3,808	48.6
Central Luzon	41.8	7.0	11.2	3,847	61.4
Southern Tagalog	36.9	4.7	12.6	3,922	52.8
Central Visayas	32.0	3.0	6.8	3,361	43.6
Southern Mindanao	33.5	6.9	6.2	4,210	39.5
Western Visayas	28.3	1.7	7.2	3,753	41.8
Less Urbanized	23.3	3.8	16.4	3,440	38.1
Ilocos	23.8	3.2	4.7	3,455	41.6
Bicol	21.5	3.9	4.2	3,194	40.7
Eastern Visayas	21.8	3.9	3.4	3,443	30.2
Northern Mindanao	26.6	3.8	4.1	3,801	38.6
Rural	17.1	4.0	6.7	3,804	33.0
Cagayan Valley	15.5	3.6	1.9	3,683	28.8
Western Mindanao	17.0	3.4	2.4	3,721	33.0
Central Mindanao	18.8	4.9	2.4	4,020	37.5

Source: Raymundo, C. (1983; Table 4.8, p. 73) from various census publications.

Table 5

THE ROLE OF SELECTED VARIABLES IN INFLUENCING THE PROPORTION OF TOTAL EXPENDITURE ON FOOD[a]

Component of Demand	Projections for Food (1)	Projections for Nonfood (2)	Average Allocation Ratio 1/(1+2) (3)	Col. (3)/ 53.82 (4)[b]
Expenditure Growth (1/2 percent per year, distributed to the urban and rural sectors equally)	7,090	12,715	35.80	.665
Demographic Factors				
Total Population Growth	123,083	101,477	54.81	1.018
Family Size Growth	16,866	-16,866	-	-
Rural-Urban Migration (1 percent per year)	24,847	35,212	41.37	.769
Total Demographic	164,796	119,823	57.90	1.076
Total Demand	171,886	132,538	56.46	1.049

[a] This table is based on the linear demand functions.

[b] The average Philippine expenditure on food in 1961 was 53.82 percent. If colum (3) is greater (less) than this ratio (i.e., column (4) is greater (less) than unity), then the indicated component is operating to shift relative demand toward (away from) food products.

Source: Kelley, A.C (1969; Table III, p. 122).

Table 6

PERCENT DISTRIBUTION OF FAMILY EXPENDITURES FOR FOOD AND FUEL, LIGHT AND WATER BY AREA: PHILIPPINES, 1961-1975

Expenditure Item	Year	Philippines	Rural	All Urban	Metro Manila Only	Other Urban
Food	1961	55.8	59.5	48.4	42.3	52.3
	1965	53.7	60.6	46.1	40.4	50.5
	1971	53.7	59.3	47.1	41.5	49.6
	1975	52.2	56.2	46.4	45.4	47.9
Fuel, Light & Water	1961	4.0	4.1	3.9	3.8	4.0
	1965	3.6	3.7	3.6	3.6	3.5
	1971	3.6	3.6	3.6	3.9	3.5
	1975	4.6	4.5	4.7	4.7	4.7

Source: National Economic and Development Authority, 1983 Philippine Statistical Yearbook, Manila, 1983, Table 2.9.

Table 7

AVERAGE FAMILY EXPENDITURES FOR FOOD BY URBAN-RURAL AREA AND BY SELECTED INCOME CLASS: PHILIPPINES, 1957-71

Area		Selected Income Categories				
		Under 500	1500-1999	3000-3999	5000-5999	10000-14999
Philippines	1957	235[a/]	754	1156	2138	-
		(56.5)	(48.5)	(38.4)	(26.0)	-
	1961	475	1035	1488	2219	3557
		(65.6)	(56.7)	(46.2)	(48.2)	(32.4)
	1965	775	1365	2020	2655	4758
		(67.2)	(61.0)	(54.0)	(48.2)	(32.3)
	1971	1133	1833	2462	3165	5015
		(69.3)	(62.1)	(57.1)	(51.8)	(43.4)
Urban	1957	225	551	662	874	-
		(51.2)	(45.4)	(36.3)	(28.4)	-
	1961	469	1095	1682	2326	3573
		(66.1)	(55.9)	(49.9)	(45.9)	(32.0)
	1965	840	1369	1949	2556	42.70
		(61.6)	(53.2)	(49.6)	(45.9)	(29.2)
	1971	n.a.	n.a.	n.a.	n.a.	n.a.
Rural	1957	234	750	1071	1358	-
		(64.6)	(52.7)	(44.1)	(30.8)	-
	1961	477	990	1380	1989	3367
		(66.5)	(57.5)	(52.0)	(48.2)	(39.5)
	1965	764	1330	1929	2321	3599
		(66.7)	(59.5)	(56.6)	(50.4)	(41.1)
	1971	n.a.	n.a.	n.a.	n.a.	n.a.

a/ The first number is the average expenditure in current pesos while the number in parenthesis below is the percent share of food expenditures to total expenditures.

Source: Tan, E. and G. Tecson (1974; Table 1, pp. 49-50) from NCSO family income and expenditures survey data for various years.

Table 8

REGRESSION ESTIMATES OF ENGEL CURVES FOR FOOD
BY URBAN-RURAL FAMILIES: PHILIPPINES, 1957-1971

Area/Food Item	Year	a	b	t	E	$\bar{R}^2$
Philippines:						
Food	1957	.533	.734	32.044	.813	.988
	1961	.568	.748	42.142	.819	.994
	1965	1.692	.715	35.579	.775	.992
	1971	.735	.727	40.327	.785	.992
Cereals	1957	-	-	-	-	-
	1961	1.086	.458	20.046	.593	.975
	1965	3.374	.387	13.572	.484	.949
	1971	1.627	.362	12.332	.452	.926
Protein	1957	-	-	-	-	-
	1961	-.409	.888	34.334	1.153	.991
	1965	-1.045	.916	27.570	1.162	.987
	1971	-.325	.873	26.313	1.111	.982
Other Food	1957	-	-	-	-	-
	1961	.059	.768	12.735	.978	.941
	1965	-.782	.857	11.981	1.126	.935
	1971	-.624	.966	32.420	1.211	.988
Urban:						
Food	1957	.654	.675	17.166	.757	.960
	1961	.573	.747	33.052	.818	.990
	1965	1.749	.701	25.631	.768	.985
	1971	2.550	.250	1.798	.264	.212
Cereals	1957	-	-	-	-	-
	1961	.963	.488	21.013	.637	.977
	1965	2.980	.428	17.357	.542	.968
	1971	2.606	.098	1.111	.121	.093
Protein	1957	-	-	-	-	-
	1961	.217	.717	13.099	.919	.944
	1965	-.839	.899	24.368	1.128	.983
	1971	1.806	.313	2.007	.387	.251
Other Food	1957	-	-	-	-	-
	1961	-.373	.887	27.866	1.137	.987
	1965	-1.012	.899	27.773	1.158	.987
	1971	1.893	.310	1.820	.374	.216

Table 8 (cont.)

Area/Food Item	Year	a	b	t	E	$\bar{R}^2$
Rural:						
Food	1957	.376	.786	18.530	.867	.966
	1961	.377	.808	56.269	.879	.966
	1965	3.439	.511	2.473	.541	.379
	1971	-	-	-	-	-
Cereals	1957	-	-	-	-	-
	1961	.883	.528	22.081	.671	.979
	1965	3.036	0.441	4.064	.535	.623
	1971	-	-	-	-	-
Protein	1957	-	-	-	-	-
	1961	-.717	.981	51.478	1.273	.996
	1965	.005	.795	4.985	1.001	.713
	1971	-	-	-	-	-
Other Food	1957	-	-	-	-	-
	1961	-.736	.991	18.047	1.278	.970
	1965	.344	.728	4.343	.944	.653
	1971	-	-	-	-	-

Source: Tan, E. and G. Tecson (1974; Table 8, pp. 88-90). Food category "Protein" includes fish, meat, eggs, milk, etc.; while category "Other Food" includes roots, vegetables, and miscellaneous.

Table 9

REGRESSION PARAMETERS OF CONSUMPTION EXPENDITURES ACCORDING TO FAMILY SIZE AND EXPENDITURE ITEM PHILIPPINES, 1971

Food/Food Category	Family Size	a	b	$\bar{R}^2$
Food	3-4	530.75	.42	.99
	5-6	740.82	.39	.98
	7-8	767.40	.43	.99
	9-10	999.69	.40	.98
Cereal	3-4	440.07	.06	.94
	5-6	614.99	.05	.89
	7-8	880.93	.04	.46
	9-10	951.10	.05	.88
Protein	3-4	67.24	.18	.98
	5-6	48.27	.18	.98
	7-8	-41.86	.20	.99
	9-10	-4.65	.19	.98
Other Food	3-4	29.41	.16	.99
	5-6	77.17	.14	.99
	7-8	-23.09	.16	.99
	9-10	20.46	.15	.98

Source: Tan, E. and G. Tecson (1974; Table 10, p. 92).

Table 10

PRICE AND INCOME ELASTICITIES: PHILIPPINES, 1965

Commodity	Philippines		Urban		Manila		Rural	
	Own Price	Income	Own Price	Income	Own Price	Income	Own Price	Income
Cereals	-0.258	0.296	-0.317	0.336	-0.269	0.362	-0.479	0.429
Fish and Other Sea Foods	-0.382	0.483	-0.425	0.479	-0.331	0.469	-0.333	0.707
Meat and Eggs	-0.821	1.083	-0.890	1.042	-0.648	0.946	-0.578	1.151
Milk and Dairy Products	-0.757	0.999	-0.578	0.684	-0.457	0.673	-0.606	1.271
Roots	-0.508	0.658	-0.617	0.717	-0.490	0.729	-0.301	0.692
Miscellaneous	-0.503	0.651	-0.552	0.633	-0.409	0.595	-0.337	0.744
Food Consumed Outside	-0.926	1.242	-0.896	1.050	-0.531	0.786	-0.528	1.287

Source: Canlas, D. (1983; Table 10, p. 18).

Table 11

INCOME-QUANTITY ELASTICITIES FOR SELECTED FOOD ITEMS, 11 SURVEYS, MAY-JUNE 1974 - DECEMBER 1976, PHILIPPINES

Food Item	Elasticity	Food Item	Elasticity
Cereals		Protein	
Rice and products	0.15	Pork	0.80
Rice	0.13	Beef and carabeef	0.86
Corn and products	-0.55	All poultry meat	0.78
Corn	-0.59	All eggs	0.72
Wheat products	0.63	All dairy products	0.68
		All fresh and frozen fish	0.37
Other Food		Dried and smoked fish	0.13
All fruits	0.35		
All leafy and yellow vegetables	0.26		
All fruit vegetables	0.35		
All roots, bulbs and tubers	-0.08		

Source: Aviguetero, E.F., et al. (1978; Table 24, pp. 19-21).

Table 12

CHARACTERISTICS OF SAMPLE HOUSEHOLD BY INCOME LEVEL, MINISTRY OF AGRICULTURE FOOD CONSUMPTION SURVEY, 1976

Characteristic	Income Level		
	Low	Middle	High
Average household income (₱/yr.)	2504	5802	15019
Average household size	5.9	6.4	7.2
Average per capita income (₱/yr.)	424	906	2086
Average food expenditure (₱/wk.)	72	97	147
Average per capita food expenditure (₱/wk.)	12	15	20
Percent of income spent on food	49	87	51
Number of sampled households*/	1102	955	891
Distribution of households (%)	37	32	30

*/ Only 3 of the 4 surveys for 1976 were included in the analysis of consumption patterns by income level. Households with extreme income values were also excluded from the analysis (author's original note).

Source: Bennagen, M.E. (1980; Table 15, p. 94).

Table 13

EXPENDITURE SHARES AND AVERAGE PER CAPITA CONSUMPTION OF MAJOR FOOD GROUPS BY INCOME LEVEL: PHILIPPINES, 1976

Major Food Item	Income Level		
	Low	Middle	High
Cereals	45.9 (134.0)[a]	41.1 (134.1)	33.7 (141.6)
Red meat	9.5 (6.2)	12.6 (9.7)	17.6 (16.6)
Poultry meat	4.0 (2.6)	4.3 (3.2)	5.4 (5.8)
Eggs	2.9 (1.8)	3.7 (3.2)	4.0 (5.1)
Dairy product	4.7 (5.3)	5.6 (7.3)	6.9 (10.1)
Seafoods	16.4 (22.0)	16.4 (25.2)	16.6 (28.9)
Fruits	5.9 (42.3)	5.6 (41.4)	6.2 (52.7)
Vegetables	7.3 (32.6)	7.8 (36.6)	7.1 (41.9)
Rootcrops, bulbs & tubers	3.3 (20.3)	2.8 (16.2)	2.6 (17.3)
All Foods	100.0 (267.0)	100.0 (277.1)	100.0 (320.0)

Source: Bennagen, M.E. (1980; Tables

[a] The first number is the percent share of the ith food item to total food expenditures, while the number in parenthesis is the average annual per capita consumption in kilos per year.

Table 14

ESTIMATED EXPENDITURE AND QUANTITY ELASTICITIES FOR MAJOR FOOD GROUPS: PHILIPPINES, 1976

Major Food Groups	Income Elasticity		Household Size Elasticity*/
	Expenditure Model	Quantity Model	
Cereals	.13	.05	.70
Red meat	.52	.44	.18
Poultry meat	.19	.16	.26
Eggs	.32	.32	.34
Dairy products	.39	.24	.24
Seafoods	.33	.19	.44
Fruits	.40	.16	.41
Vegetables	.30	.17	.40
Rootcrops, bulbs & tubers	.12	-.21	.47
Total Food	.33	.12	.47

*/ Based on expenditure model.

Source: Bennagen, M.E. (1980; Table 9, pp. 66-67; and Table 13, p. 87).

Table 15

ESTIMATED EXPENDITURE, QUANTITY AND HOUSEHOLD SIZE ELASTICITIES FOR MAJOR FOOD GROUPS BY INCOME LEVEL: PHILIPPINES, 1976

Major Food Group/Elasticity	Income Level		
	Low	Middle	High
Cereals			
Expenditure	.04*	.30	.12
Quantity	-.01*	.19	.05*
N_{10}	.61	.60	.53
N_9	.03	.03	.03
Red Meat			
Expenditure	.08*	.64	.55
Quantity	-.01*	.65	.43
N_{10}	.43	.27	.19
N_9	-	-	-
Poultry Meat			
Expenditure	.01*	.20*	.21
Quantity	.05*	.24*	.21
N_{10}	.22	.16	.25
N_9	.01*	.02	-
Eggs			
Expenditure	.28	.46	.34
Quantity	.27	.45	.39
N_{10}	.26	.36	.28
N_9	-	-	.02
Dairy Products			
Expenditure	.19	.36	.48
Quantity	.20	.38	.20
N_{10}	-.07*	-	.06*
N_9	.03	.03	.04
Seafood			
Expenditure	.21	.36	.32
Quantity	.14	.23*	.02*
N_{10}	.39	.36	.45
N_9	.01*	-	.01*

Table 15 (cont.)

Major Food Group/Elasticity	Income Level		
	Low	Middle	High
Fruits			
Expenditure	.14	.36	.41
Quantity	.-*	.17*	.20
N_{10}	.36	.34	.35
N_9	.02	.01*	.01*
Vegetables			
Expenditure	.22	.49	.27
Quantity	.10	.26	.13
N_{10}	.34	.36	.37
N_9	.01*	.01*	.02
Rootcrops, bulbs & tubers			
Expenditure	-.13	.12*	.32
Quantity	-.51	-.39*	.37
N_{10}	.25	.35	.47
N_9	.02	.02	.03
All Food			
Expenditure	.14	.44	.34
Quantity	.01*	.22	.14
N_{10}	.44	.40	.38
N_9	.02	.02	.02

*/ Not significant at 10 percent level.

Source: Bennagen, M.C. (1980; Tables 21 and 22).

Table 16

MEAN ONE-DAY PER CAPITA FOOD CONSUMPTION (g/day): PHILIPPINES, 1978 AND 1982

Food Groups	1978					1982				
	Philippines	All Urban	Metro Manila	Other Urban	Rural	Philippines	All Urban	Metro Manila	Other Urban	Rural
Energy Foods										
Cereals & Cereal Products	367	323	-	-	390	356	320	287	341	374
Starchy Roots & Tubers	37	20	-	-	46	42	19	18	20	54
Sugars & Syrups	27	43	-	-	19	22	28	30	27	20
Fats & Oils	13	20	-	-	10	14	18	23	16	11
Body-Building Foods										
Fish, Meat & Poultry	133	168	-	-	116	154	183	179	184	140
Eggs	8	14	-	-	5	9	14	14	14	7
Milk & Milk Products	33	55	-	-	22	44	64	83	53	34
Dried Beans, Nuts & Seeds	8	9	-	-	8	10	11	14	9	9
Regulating Foods										
Green Leafy & Yellow Vegetables	34	28	-	-	38	37	26	19	30	42
Vitamin C-Rich Foods	47	54	-	-	44	36	47	53	44	31
Other Fruits & Vegetables	168	174	-	-	166	159	183	210	167	148
Miscellaneous	21	23	-	-	19	32		37	31	31

Source: Food and Nutrition Research Institute (1981, 1983).

Table 17

MEAN ONE-DAY PER CAPITA FOOD CONSUMPTION (g/day) BY INCOME
PHILIPPINES, 1978 AND 1982

Food Groups	1978 Annual Per Capita Income Groups[a]							1982 Annual Per Capita Income Groups[a]						
	A	B	C	D	E	F	G	A	B	C	D	E	F	G
Energy Foods														
Cereals & Cereal Products	368	380	371	360	355	[346][b]		343	368	366	371	362	352	337
Starchy Roots & Tubers	54	34	35	40	22	[17]		95	32	53	44	24	34	36
Sugar & Syrups	13	18	26	37	47	[58]		13	13	18	20	23	25	33
Fats & Oils	8	9	12	15	21	[26]		7	9	10	11	15	15	21
Body-Building Foods														
Fish, Meat & Poultry	86	117	132	151	175	[223]		73	99	126	153	160	167	224
Eggs	3	4	7	12	17	[22]		1	4	5	7	9	14	18
Milk & Milk Products	12	18	30	51	59	[79]		10	14	18	31	43	61	97
Dried Beans, Nuts & Seeds	6	7	8	8	13	[11]		5	9	8	10	10	9	13
Regulating Foods														
Green Leafy & Yellow Vegetables	37	37	32	36	30	[30]		59	41	43	35	35	33	27
Vitamin C-Rich Foods	24	33	50	60	79	[83]		11	23	27	33	39	40	59
Other Fruits & Vegetables	139	156	173	187	190	[209]		122	153	125	131	171	185	211
Miscellaneous	13	17	22	26	20	[24]		17	29	27	32	32	33	40

[a] Income groups: A = less than ₱250; B = ₱250-499; C = ₱500-999; D = ₱1,000-1,499; E = ₱1,500-1,999
F = ₱2,000-2,999; G = ₱3,000 and over.

[b] Income group ₱2,000 and over.

Source: Food and Nutrition Research Institute (1981; 1983).

Table 18

MEAN ONE-DAY PER CAPITA FOOD CONSUMPTION (g/day) BY OCCUPATION OF HOUSEHOLD HEAD: PHILIPPINES, 1978

Food Groups	Occupation of Household Head						
	Professional Technical, Entrepreneurs, Skilled	Farm Owners and Managers	Farm Workers	Fishermen (mostly small & hired)	Other Occupation (mostly skilled)	Housewives, Students Retired	No Occupation
Energy Foods							
Cereals & Cereal Products	321	415	392	369	343	346	369
Starchy Roots & Tubers	24	36	48	47	38	17	28
Sugar & Syrups	47	21	16	15	30	45	28
Fats & Oils	22	21	16	15	30	45	28
Body-Building Foods							
Fish, Meat & Poultry	177	128	100	142	131	176	131
Eggs	17	6	3	3	9	17	7
Milk & Milk Products	60	26	12	14	43	55	31
Dried Beans, Nuts & Seeds	11	8	7	4	8	11	9
Regulating Foods							
Green Leafy & Yellow Vegetables	29	38	40	32	32	32	33
Vitamin C-Rich Foods	63	48	37	29	46	75	45
Other Fruits & Vegetables	196	176	156	121	170	199	133
Miscellaneous	22	23	21	16	19	21	15

Source: Food and Nutrition Institute (1981).

Table 19

MEAN ONE-DAY PER CAPITA PESO VALUE OF FOOD FROM ALL SOURCES, BOUGHT AND NOT BOUGHT BY URBANIZATION: PHILIPPINES, 1978 AND 1982

Area	1978				1982			
	Mean One-Day Per Capita Peso Value of Food			Percent of All Food Sources Not Bought	Mean One-Day Per Capita Peso Value of Food			Percent of All Food Sources Not Bought
	All Sources	Bought	Not Bought		All Sources	Bought	Not Bought	
Philippines	2.78	2.22	0.57	20.5	3.99	3.33	0.66	16.5
All Urban	3.79	3.49	0.29	7.7	5.22	4.72	0.49	9.4
Metro Manila	-	-	-	-	5.96	5.58	0.38	6.4
Other Urban	-	-	-	-	4.76	4.20	0.56	11.8
Rural	2.27	1.56	0.71	31.3	3.38	2.64	0.74	21.9

Source: Food and Nutrition Research Institute (1981; 1983).

Table 20

INCOME ELASTICITIES OF PER CAPITA CONSUMPTION OF FOOD GROUPS, BY URBANIZATION: PHILIPPINES, 1978 AND 1982

Food Groups	1978					1982				
	Philippines	All Urban	Metro Manila	Other Urban	Rural	Philippines	All Urban	Metro Manila	Other Urban	Rural
Energy Foods										
Cereals & Cereal Products	-0.01	-0.01	-	-	*/	-0.04	-0.06		-0.05	-0.02
Starchy Roots & Tubers	0.02	0.05	-	-	-0.02	-0.04	n.a.	-0.14	-0.07	-0.05
Sugar & Syrups	0.38	0.43	-	-	0.32	0.41	0.31	0.32	0.29	0.44
Fats & Oils	0.26	0.29	-	-	0.22	0.37	0.39	0.24	0.38	0.30
Body-Building Foods										
Fish, Meat & Poultry	0.24	0.21	-	-	0.28	0.35	0.29	0.24	0.31	0.37
Eggs	0.42	0.46	-	-	0.37	0.45	0.46	0.29	0.49	0.38
Milk & Milk Products	0.63	0.65	-	-	0.61	0.78	0.83	0.58	0.83	0.63
Dried Beans, Nuts & Seeds	0.17	0.20	-	-	0.13	0.18	0.19	0.02	0.21	0.17
Regulating Foods										
Green Leafy & Yellow Vegetables	-0.01	*/	-	-	-0.03	-0.14	-0.12	-0.04	-0.11	-0.14
Vitamin C-Rich Foods	0.46	0.39	-	-	0.54	0.41	0.43	0.12	0.46	0.37
Other Fruits & Vegetables	0.33	0.37	-	-	0.28	0.32	0.41	0.16	0.41	0.18
Miscellaneous	0.06	0.04	-	-	0.07	0.14	0.17	0.28	0.17	0.12

*/ Inclusive of ± 0.004

Source: Food and Nutrition Research Institute (1981; 1983).

Table 21

INCOME ELASTICITIES OF PER CAPITA CONSUMPTION OF FOOD GROUPS, BY INCOME LEVEL: PHILIPPINES, 1978

Food Groups	Per Capita Income Level		
	Less than ₱500	₱500-1500	Above ₱1500
Energy Foods			
Cereals & Cereal Products	0.04	-0.02	-0.04
Starchy Roots & Tubers	-0.16	-	0.14
Sugar & Syrups	0.17	0.63	0.31
Fats & Oils	0.06	0.39	0.07
Body-Building Foods			
Fish, Meat & Poultry	0.29	0.21	0.22
Eggs	0.09	0.65	0.23
Milk & Milk Products	0.28	1.31	0.45
Dried Beans, Nuts & Seeds	0.13	0.29	0.18
Regulating Foods			
Green Leafy & Yellow Vegetables	0.10	-0.14	0.20
Vitamin C-Rich Foods	0.45	0.32	0.05
Other Fruits & Vegetables	0.29	0.56	0.24
Miscellaneous	0.05	0.08	0.09

Source: Food and Nutrition Research Institute (1981).

Table 22

REGRESSION ON PER CAPITA PESO VALUE OF FOOD CONSUMED (BOUGHT): PHILIPPINES, 1978[a/]

	Independent Variables	Dependent: Per Capita Peso Value	
		All Food Consumed	Bought Food Only
1.	Per Capita Income	0.25 (0.01)	0.33 (0.02)
2.	Percent of Household Members 13 Years and Over	0.30 (0.03)	0.20 (0.04)
3.	Household Size	-0.08 (0.02)	-0.04 (0.03)*
4.	Urbanization (Rural)	-0.18 (0.03)	-0.70 (0.04)
5.	Meal Planners Years of Schooling	0.12 (0.01)	0.15 (0.02)

[a/] Regression equation specified in double log form.

[*/] Not significant.

Source: Food and Nutrition Research Institute (1981).

Table 23

SELECTED ESTIMATES OF INCOME/EXPENDITURE ELASTICITIES FOR FOOD BY RURAL AND URBAN AREAS: PHILIPPINES

Source/Year	Philippines	All Urban	Metro Manila	Other Urban	Rural	Equation (units of observation)
		A. Total Food				
Tan and Tecson: A						
(1957)	0.813	0.757	-	-	0.867	$\ln E_{ik} = a + b \ln E_k$
(1961)	0.819	0.818	-	-	0.879	
(1965)	0.775	0.768	-	-		
(1971)	0.785	-				(grouped data by income class)
Tan and Tecson: B						
(1971)	0.667	-	-	-	-	$E_{ik} = a + b_1 N_k + b_2 E_k$ (grouped data by income class)
Brannagen (1976)						
A	0.33					$E_{ij} = a_{0i} + a_{1i} \ln Y_j + a_{2i} N_j$ (household)
B	0.12					$Q_{ij} = b_{0i} + b_{1i} \ln Y + b_{2i} \ln N_j$ (household)
		B. Cereals				
Tan and Tecson: A						
(1961)	0.593	0.637	-	-	0.671	Same as in A above
(1965)	0.484	0.542	-	-	0.535	
(1971)	0.452	-	-	-	-	
Canlas (1965)	0.296	0.336	0.362	-	0.429	LES (grouped data by income class)
Aviguetero, et al. (1974-76)						
Rice & Products	0.15	-	-	-	-	$\ln \frac{Q_{ij}}{N_j} = a + b \ln \frac{Y_j}{N_j}$ (households)
Rice	0.13					
Corn & Products	-0.55					
Corn Grits	-0.59					
Wheat Products	-0.63					

Table 23 (cont.)

Source/Year	Philip-pines	All Urban	Metro Manila	Other Urban	Rural	Equation (units of observation)
Bennagen (1976)						
A	0.13					Same as above
B	0.05					
FNRI (1978)	-0.01	-0.01	-	-	-	$\ln \frac{QD_{ij}}{N_j} = a + b \ln \frac{Y_j}{N_j}$
(1982)	-0.04	-0.06	-0.03	-0.05	-0.02	(households, one-day data)
C. Starchy Roots and Tubers						
Bennagen (1976)						
A	0.12	-	-	-	-	Same as above
B	-0.21	-	-	-	-	
FNRI (1978)	0.02	0.05	-	-	-	Same as above
(1972)	-0.04	-	-0.14	-0.07	-0.05	
D. Protein/Body-Building Foods						
Tan and Tecson: A						
(1961)	1.153	0.919	-	-	1.273	Same as in
(1965)	1.162	1.128	-	-	1.001	A above
(1971)	1.111	-	-	-	-	
Canlas (1965)						
Fish & Other Seafoods	0.483	0.479	0.469	-	0.707	Same as
Meat & Eggs	1.083	1.043	0.946	-	1.151	above
Milk & Dairy Products	0.999	0.684	0.673	-	1.271	
Aviguetero, et al. (1974-76)						
Pork	0.80	-	-	-	-	
Beef/Carabeef	0.86	-	-	-	-	Same as
All Poultry Meat	0.78	-	-	-	-	above
All Eggs	0.72	-	-	-	-	
All Dairy Products	0.68	-	-	-	-	
All Fresh/ Frozen Fish	0.37	-	-	-	-	
Dried & Smoked Fish	0.13	-	-	-	-	

Table 23 (cont.)

Source/Year		Philippines	All Urban	Metro Manila	Other Urban	Rural	Equation (units of observation)
Bennagen (1976)							
Red Meat	A	0.52	-	-	-	-	
	B	0.44	-	-	-	-	
Poultry Meat	A	0.19	-	-	-	-	Same as
	B	0.16	-	-	-	-	above
Eggs	A	0.32	-	-	-	-	
	B	0.32	-	-	-	-	
Dairy Products	A	0.39	-	-	-	-	
	B	0.24	-	-	-	-	
Seafoods	A	0.33	-	-	-	-	
	B	0.19	-	-	-	-	
FNRI							
Fish, Meat, Poultry	1978	0.24	0.21	-	-	0.28	
	1982	0.35	0.29	0.24	0.31	0.37	
Eggs	1978	0.42	0.46	-	-	0.37	Same as
	1982	0.45	0.46	0.29	0.49	0.38	above
Milk & Milk Products	1978	0.63	0.65	-	-	0.61	
	1982	0.78	0.83	0.58	0.83	0.63	
Dried Beans, Nuts, Seeds	1978	0.17	0.20	-	-	0.13	
	1982	0.18	0.19	0.02	0.21	0.17	
		E. Regulating Foods					
Tan and Tecson: A							
	(1961)*	.978	1.137	-	-	1.278	Same as in
	(1965)*	1.126	1.158	-	-	0.944	A above
	(1971)*	1.211	.374	-	-	-	
Aviguetero, et al. (1974-76) f/							
All Leafy & Yellow Vegetables		0.26	-	-	-	-	Same as
All Fruit Vegetables		0.35	-	-	-	-	above
All Fruits		0.35	-	-	-	-	

Table 23 (cont.)

Source/Year		Philippines	All Urban	Metro Manila	Other Urban	Rural	Equation (units of observation)
Bennagen (1976)							
Vegetables	A	0.30	-	-	-	-	Same as above
	B	0.17	-	-	-	-	
Fruits	A	0.40	-	-	-	-	
	B	0.16	-	-	-	-	
FNRI							
Green Leafy & Yellow Vegetables	1978	-0.01	-	-	-	-0.03	Same as above
	1982	-0.14	-0.12	-0.04	-0.11	-0.14	
Vitamin C-Rich Foods	1978	0.46	0.39	-	-	0.54	
	1982	0.41	0.43	0.12	0.46	0.37	
Other Fruits & Vegetables	1978	0.33	0.37	-	-	0.28	
	1982	0.32	0.41	0.16	0.41	0.18	

*/ Includes roots, vegetables and miscellaneous.

Definition of variables:

E_{ik} = mean expenditures on ith food item by kth income class

E_k = mean family expenditures in kth income class

N_k = average family size in kth income class

Q_{ij} = weekly quantity consumed in ith food item by jth household

E_{ij} = weekly expenditures on ith food item by jth household

Y_j = total annual income of jth household

N_j = total number of households members in jth household

QD_{ij} = one-day quantity consumed of ith food item by jth household

Table 24

ANNUAL ENERGY CONSUMPTION OF HOUSEHOLDS
BY ENERGY ITEM AND BY AREA:
PHILIPPINES, 1977

Energy Item	Energy Consumption Per Household		
	Rural	Urban	Philippines
Non-Commercial Energy			
Firewood	1.43 (34.7)[a]	3.41 (32.8)	1.87 (33.9)
Woodwaste	0.01 (0.3)	0.02 (0.2)	0.80 (0.3)
Charcoal	0.64 (15.5)	1.35 (12.9)	0.37 (14.4)
Coconut Shells	0.46 (11.1)	0.06 (0.6)	0.01 (6.7)
Rice Hulls	0.04 (0.9)	0.12 (1.1)	0.06 (1.0)
Biogas	nil (n.a.)	0.01 (0.06)	nil (0.03)
Sub-total	2.58 (62.5)	4.97 (47.7)	3.11 (56.3)
Commercial Energy			
Electricity	0.07 (1.7)	0.40 (3.9)	0.14 (2.6)
Petroleum:	1.48 (35.8)	5.04 (48.4)	2.27 (41.1)
Gasoline	0.62 (14.8)	2.40 (23.1)	1.01 (18.3)
Kerosene	0.74 (17.9)	1.58 (15.1)	0.93 (16.8)
Diesel	0.05 (1.3)	0.49 (4.7)	0.15 (2.7)
LPG	0.07 (1.8)	0.57 (5.5)	0.18 (3.3)
Sub-total	1.55 (37.5)	5.44 (52.3)	2.41 (43.7)
Total	4.13 (100.0)	10.41 (100.0)	5.52 (100.0)
Total (MBOE)	21,147	15,164	36,311

[a] The first number refers to the annual energy consumption in BOE equivalent per household while the number in parentheses refers to the percent of total energy consumption.

Source: Ministry of Energy, Energy Sectoral Survey Series, Manila, December 1982; Tables I.a.1 - I.c.3.

Table 25

ENERGY PURCHASED, PRODUCED AND OBTAINED BY HOUSEHOLDS BY MAJOR ENERGY ITEM, BY AREA AND BY INCOME CLASS: PHILIPPINES, 1977

Energy Item/Area	Income Level			
	Less than ₱2,500	₱2,500-7,999	₱8,000 & over	All Income Groups
Non-commercial Energy (%)				
Philippines	60.5	51.0	34.1	56.3
Rural	62.5	61.5	74.2	62.5
Urban	57.5	37.2	11.1	47.7
Commercial Energy (%)		49.0		
Philippines	39.5	49.0	65.9	43.7
Rural	37.5	38.5	25.8	37.5
Urban	42.5	62.8	88.9	52.3
Total Energy Consumed (MBOE)				
Philippines	22,845	12,000	1,466	36,311
Rural	13,806	6,805	533	21,147
Urban	9,036	5,195	933	15,164

Source: Ministry of Energy, Energy Sectoral Survey Series, Manila, December 1982; Tables I.d.1-I.f.3.

Table 26

REGRESSION ANALYSIS OF ENERGY CONSUMPTION: PHILIPPINES, 1977

Dependent Variable	Independent Variables: Middle Range Family Size (FS) [a/]		Average Annual Household Income (I) [b/]		Price Per Energy Item (PC) [c/]		$\bar{R}^2$
1. Per Household Total Energy Consumption							
Philippines	-0.8331	(-1.0953) [d/]	-0.0005	(-0.4783)	0.0343*	(2.113)	0.61
Rural	-0.4932	(-0.9409)	-0.0004	(-0.3083)	0.0330*	(2.5536)	0.68
Urban	-0.8197	(-0.4197)	-0.0009	(-0.5655)	0.0291	(0.5326)	0.28
2. Per Household Non-Commercial Energy Consumption							
Philippines	0.1085	(0.1877)	-0.0002	(-0.2469)	0.0059	(0.9143)	0.35
Rural	0.2674	(0.5730)	0.0005	(0.4045)	0.0010	(0.6308)	0.51
Urban	-0.6739	(-0.4139)	-0.0006	(-0.5488)	0.0106	(0.5175)	0.24
3. Per Household Commercial Energy Consumption							
Philippines	.00184*	(1.7082)	-0.0003	(-0.3992)	-0.5452	(-1.0043)	0.52
Rural	-0.4054*	(-2.1202)	-0.0009*	(-2.0251)	0.1443*	(2,3120)	0.69
Urban	-0.0346	(-0.0468)	-0.0003	(-0.2804)	-0.0036	(-0.0960)	0.11

a/ Middle Range Family Size (FS) Per Region (approximated by largest family size reported in the region divided by 2).

b/ Average Annual Household Income (I) Per Region (from NEDA and MOE statistics).

c/ Price Per Energy Item (PC) (approximated by the Regional Energy Bill divided by Regional Energy Consumption in BOE).

d/ t-value in parenthesis

Source: Ministry of Energy, Energy Sectoral Survey Series, Manila, December 1982, Tables IIa-IIc.

Table 27

PERCENT OF HOUSEHOLDS BY TYPE OF FUEL USED BY SOCIOECONOMIC CLASS
URBAN PHILIPPINES, 1979

Fuel Used	All Households	Socioeconomic Class					
		Philippines			Metro Manila		
		High	Middle	Low	High	Middle	Low
Electricity	90	99	98	82	100	100	99
Kerosene	68	38	58	83	18	41	71
Candle	66	74	73	59	96	93	88
Wood	38	45	47	70	26	26	46
Charcoal	56	52	50	63	35	29	27
LPG	50	86	70	25	88	83	49
Batteries	48	54	47	47	61	56	45
Others	4	2	3	5	4	2	2
Number of Households	1,999	187	833	979	83	372	295

Source: Ministry of Energy, Energy Sectoral Survey Series, Manila, December 1982; Tables 1 and 2, pp. 82-83.

Table 28

USUAL SOURCES OF ENERGY BY HOUSEHOLD FUNCTION, AND SOCIO-ECONOMIC CLASS: URBAN PHILIPPINES AND METRO MANILA, 1979

Source/ Function	All Households	Urban Philippines			Metro Manila		
		High	Middle	Low	High	Middle	Low
Lighting	100	100	100	100	100	100	100
Electricity	90	99	98	82	100	100	99
Kerosene	10	1	2	18	-	-	1
LPG	-	-	-	-	-	-	-
Candle	-	-	-	-	-	-	-
Cooking	100	100	100	100	100	100	100
Electricity	9	12	13	4	19	19	11
LPG	40	74	57	20	78	73	45
Kerosene	15	2	9	23	1	5	35
Wood	30	10	16	47	1	2	9
Charcoal	5	2	5	5	-	1	1
Others	1	-	-	1	-	-	-
Ironing	95	98	98	92	98	99	90
Electricity	59	76	73	44	98	99	87
Charcoal	36	20	24	48	-	-	3
Refrigeration	44	94	67	15	99	83	27
Electricity	43	93	66	15	99	83	27
Kerosene	1	1	1	-	-	-	-
Air Conditioning							
Electricity	3	20	2	-	34	3	-
Ventilation							
Electricity	55	84	76	32	95	93	64
Radio	77	92	84	68	90	88	67
Electricity	52	81	67	34	82	75	45
Battery	25	11	17	34	8	13	23
TV							
Electricity	56	93	77	31	98	92	55
Total Households	1,999	187	833	979	83	372	293

Source: Ministry of Energy, Energy Sectoral Survey Series, Manila, December, 1982; Table 4, pp. 89-90.

Table 29

AVERAGE MONTHLY FUEL EXPENDITURES (PESOS) AND SOCIOECONOMIC CLASS: URBAN PHILIPPINES AND METRO MANILA, 1979

Energy Item	All Households	Philippines			Metro Manila		
		High	Middle	Low	High	Middle	Low
Electricity	39.67	100.51	42.49	22.13	94.74	35.62	19.06
LPG	51.22	65.76	49.24	46.15	54.63	45.62	42.57
Kerosene	19.28	17.45	16.43	20.92	7.83	19.10	29.79
Wood	25.02	30.68	24.11	24.88	19.33	21.14	19.91
Charcoal	8.63	8.83	9.58	7.98	2.88	9.53	5.89
Other fuels[a/]	5.37	6.73	4.96	5.47	5.67	4.60	6.14

[a/] Includes candles and batteries.

Source: Ministry of Energy, Energy Sectoral Survey Series, Manila, December 1982, Table 10, p. 104.

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Annex A

A Simulation Model for Food and Fuel Products in the Process of Urbanization

The purpose of this note is to delineate a preliminary model that will be used to tackle the following issues:

1. the food and household fuel requirements in the Philippines in the two decades in the face of growth and urbanization

2. the distribution of these requirements among the income groups in the country

3. the extent to which policy interventions can influenc likely scenarios in the future.

The model is composed of five blocks, which are the following:

1. urban growth block which parameterizes the growth of urban centers

2. demand for food block

3. demand for fuel block

4. supply of food block

5. supply of fuel block

The model as constituted is useful for partial equilibrium analyses of the three issues stated above. A general equilibrium approach will require demand and supply equations for all components of the household budget. The supply equations (blocks 5 and 6) are intended to be highly aggregative and useful particularly for analysis of policy intervention.

An explanation of the contents of each block follows:

1. Urban Growth Block

This block parameterizes the growth process of urban centers in the Philippines. It has two main endogenous variables: urban population and urban density.

For the Philippines, the rural-to-urban migration process is the principal dynamic behind urban population growth. The main explanatory variables proposed for this process therefore have to do with urban-rural differences. The main equation for rural-to-urban migration will be:

$$(1) \qquad M_t^{ku} = f_1^{ku}\left(\left(\frac{PI}{PA}\right)_t, \left(\frac{W^u}{P}\right), LR_t, Y_t, T_t, Z_t\right)$$

where: M_t^{ku} = is the migration rate at time t for the kth skill class into the uth urban center measured in numbers of persons

$\left(\frac{PI}{PA}\right)_t$ = is the terms of trade between industry and agriculture measured as the ratio of the industrial price index over the index of agricultural prices.

W^u = wage for unskilled

LR_t = is an index of land reform implementation measured as the percentage of land affected by the program.

Y_t is the national income, an index of overall development

I_t is an index of infrastructure development of urban areas such as kilometers of paved roads, number of telephones

Z_t is a vector of other conditioning variables such as age distribution.

At the present time the feasibility of estimating this equation by income class is still in doubt. Only two urban "centers" are planned: (a) Metropolitan Manila and (b) other urban centers lumped together. It is felt that the dynamic of growth of Metropolitan Manila differs from those of other urban centers.

Total urban migration for the mth urban center at time t is the sum over the income classes:

$$(2) \qquad M_t^m = \sum_k M_t^{km}$$

At any time t, the projected population of the kth income class in the mth urban center is therefore:

$$(3) \qquad P_t^{mk} = P_o^{mk} + \sum_{t=1}^{t} M_t^{mk}$$

where P_t^{mk} is the population of the kth income class in the mth center at time t.

Should it prove impossible to estimate the migration equation by income class, on overall migration equation M_t^m, will be estimated. A vector of fractions based on the results of existing studies can then be applied to M_t^m to estimate M_t^{km} the migration of the kth income class. Because household demand functions will be used in subsequent blocks, migration and population figure will have to be converted to household units by dividing the number of people by the average number of household members. The number of households in the mth urban center of the kths income class at time t is therefore:

$$H_t^{km} = \frac{P_t^{km}}{h^{km}}$$

where h^{km} is the average size of household in locality on for the kth income class.

The density for the mth urban center is by definition:

$$D_t^m = \frac{P_t^m}{A_t^m}$$

where A_t^m is the land area of mth urban center at time t. The values of A_t^m will be based on existing regional and urban places.

2. Demand for Food Block

The principal output of this block is the demand for different food types by income class. The estimation of price and income elasticities and cross elasticities represents the bulk of the work to be carried out in this research.

We propose to estimate demand functions for each of the two urban center "types". The demand functions will have the conventional specification:

$$D_{F_t}^{\ell km} = D_{F_t}^{\ell km} \left(\underset{\sim}{P}_{-t}^{f}, Y_t^k, Z_t\right)$$

where $D_F^{\ell km}$ = is the per household demand for food type ℓ in the kth income class in the urban center or rural area indexed by m.

$\underset{\sim}{P}_{-t}$ = is a vector of prices for the food types

Y_t^k = is the household income variable for the households in the kth income class

Z_t = is a vector of other conditioning variables.

The total food demand function for the kth income class is therefore:

$$D_{F_t}^{km} = \sum_i^r D_F^{ikm} \left(\underset{\sim}{P}_{-i}^{t}, Y^k; Z\right)$$

a function that must be consistent with Engel Curve coefficients of different income groups. The estimation procedure will utilize this constraint.

These demand functions will be converted to their nutrient equivalents using technical coefficients provided by the Food and Nutrition Research Institute (FNRI).[1/] Data from Family Income and Expenditure Surveys of the NCSO and data from the 1978 and 1983 Surveys of the FNRI will be utilized in the estimation procedure.

Total demand for food type i for the kth income class in location m is therefore:

$$D_{F_t}^{ikm*} = H_t^{km} * D_{F_t}^{ikm}$$

when the number of households H_t^{km} is taken from the urban growth block.

3. Demand for Fuel Block

The energy demand by households will be measured in conventional energy units. To calculate the demand functions, it will be necessary to convert household consumption data to the energy unit using standard energy content and average efficiency factors.

The proposed household demand function for energy is the following:

$$D_{E_t}^{km} = D_{E_t}^{km} (P_{\sim t}^{e}, Y_t^k, D_t^m; Z_t)$$

where $D_{E_t}^{km}$ = is the demand for energy in location m by households in income class k.

$P_{\sim t}^{e}$ = is the vector of prices for alternative sources of energy[2/]

Y_t^k = is the income of the kth income class

D_t^m = is the population density in the mth location available from the urban growth block

Z_t = is a vector of other conditioning variables.

These energy demand equations will be estimated on household data based on the NCSO surveys and other data sets from the Ministry of Energy.

where

L_t^{ℓ} = is the land area planted to food crop ℓ in year t.

$\left(\frac{P^F}{pxc}\right)_t$ = is the ratio of the food price index to the export price index in year t.

$P_{\sim t-1}^{f}$ = is the vector of prices of different food crops in year t-1.

$\rho(L)M_t$ = is the polynomial log operator $\rho(L)$ on the rate of migration M_t which in turn is defined as

$$M_t = \sum_m \sum_k M_t^{km}$$

the total of migration to all urban centers from all income classes. This variable measures the availability of labor in the rural areas

Y_t = are other conditioning variables.

The total energy demand for households of income class k in urban location m is therefore:

$$D_{E_t}^{km*} \; H_t^{km} * D_{E_t}^{km}$$

where H_t^{km} is provided from the urban growth block. Total energy demand in urban location m is therefore:

$$D_{E_t}^{m*} = \sum_k D_{E_t}^{km*}$$

4. Supply of Food Block

The supply of food will be built up from national hectarages planted to different crops and from projections of average yield per hectare. The supply functions will build on previous work done by Bouis (1981).

For the ℓth food crop type, the area planted to that crop is determined by the following function:

$$L_t^{\ell} = L_t^{\ell}\left(\left(\frac{P^F}{P^{XC}}\right)_t, P_{t-1}^f, \rho(L)M_t; X_t\right)$$

This equation will be estimated on the national level for each major crop: rice, corn, coconuts, sugar, vegetable crops, and other crops. To determine total supply of food crops, a yield per hectare projection will be used based on an exponential fit of yield growth on historical data:

$$q_t = q_o e^{ct}$$

where q_t is the per hectare yield in year t and c is the historical average yield growth rate. In actual simulations, the possibility of declining yields will be reflected in estimates of q_t.

Total supply of food crop ℓ will then be:

$$S_{F_t}^{\ell} = q_t * L_t^{\ell}$$

For non-food crops, a direct supply equation will be estimated:

$$S_{F_t}^{\ell} = S_{F_t}^{\ell}\left(P_{t-1}^f, \rho(L)C_t, L_t; Z_t\right)$$

when the explanatory variable are

$\underset{\sim}{P}^{f}_{t-1}$ = vector of food prices in year t-1

C_t = polynomial lag on the current account balance reflecting import constraints on meat and other non-crop foods.

$\underset{\sim}{L}_t$ = vector of land own planted to the food crops.

X_t = other conditioning variables.

5. Fuel Supply Function

Fuel Supply Functions will also be estimated at the national level which will draw on previous supply studies, particularly one by Alejo (1983).

Because of the importance of foreign exchange constraints, there will be separate domestic and foreign energy supply equations will be estimated. The domestic supply equation will have the form:

$$S^{D}_{E_t} = S^{D}_{E_t}(\underset{\sim}{P}^{\ell}_{t-1}; Z_t)$$

where $\underset{\sim}{P}^{\ell}_{t-1}$ is the vector of energy prices in year t-1 and Z_t is a vector of conditioning variables. The foreign energy supply equation will be of the form:

$$S^{F}_{E_t} = S^{F}_{E_t}(\underset{\sim}{P}_{t-1}, \rho(L)C_t; Z_t)$$

where $\rho(L)C_t$ is a polynomial lag on the current account balance reflecting foreign exchange constraints.

Use of the Model for Policy Simulations

This section discusses the capabilities of the proposed model for policy analysis.

he variables that are susceptible to policy intervention in this model are the following:

$\frac{P_I}{P_A}$ - terms of trade between industry and agriculture

$\frac{P_I}{P_F}$ - ratio of industrial prices to food prices

$\underset{\sim}{P}^l$ - vector of prices

$\underset{\sim}{P}^f$ - vector of fuel prices

Y^k - level of income going to the kth income class

Many of the policy handles are actually price variables. Policy interventions including rationing are reduceable to subsidies or taxes that drive a wedge between producer cost and consumer price. While the notation above does not reflect the tax as subsidy implicit in the historical data, the planned estimation procedure will reflect the existence of taxes as subsidies.

The relevant producer's prices will be used in the supply equations while consumer's prices in the demand equations.

The income variable can be a policy handle to the extent that income redistribution measures are implemented in the future.

Footnotes

1/ An alternative method is to use the household production function approach and directly estimate the nutrient demand functions:

$$D_{F_t}^{ikm} = D_F^{ikm}\left(\Pi_t(P_{-t}, Y_t^k, T_t^k)\right)$$

for the ith nutrient type. In this function Π_t is the vector of shadow prices derived from the full income constraint which depends on prices, P_{-t}, income Y_t^k, and household time T_t^k.

2/ The specification implicitly utilizes the household production approach. The approach is extremely partial at this point because food prices are not included in P^2.