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9. ABSTRACT

The effect of income on rural and urban household consumption in the Philippines. To determine this, the expenditure elasticity of demand and marginal propensity to expend for food as the criteria of changes in consumption were used. The approach was to estimate demand functions for food items and to choose the most appropriate demand function on the basis of statistical and economic criteria. Then the two criteria for different income groups using the selected demand function were computed. This study found that the magnitude of income effect on change in consumption varied among different income classes as well as between rural and urban areas. Cereals are the main source of calories for low income families: the bottom 40% of the population spends more on cereals and seafood than on fruits, vegetables, meat, eggs, milk, and dairy products. The top 10%, in contrast, spends maximum incremental income on meat and eggs. This indicates that nutritional policies should be different for poor and rich people.

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I. Introduction

Income is one of the most important determinants of food consumption. Knowledge of food consumption patterns at the household level and its relation to income is a logical basis for the planning of self-sufficient agricultural production in low income countries. In this respect, the effects of changes in income on demand for different foods are important in setting economic and nutritional policies (Mellor, 13 and 15).

The purpose of this paper is to examine the effect of income on rural and urban household consumption in the Philippines. To do this, the expenditure elasticity of demand and marginal propensity to expend for food as the criteria of changes in consumption are used. The approach is to estimate demand functions for food items and to choose the most appropriate demand function on the basis of statistical and economic criteria. Then we compute the two criteria for different income groups using the selected demand function.

There have been some detailed consumption studies done for different food commodities in the Philippines. The National Food and Agricultural Council (5) conducted four national surveys of food consumption from 1970 to 1973. On the basis of those surveys, Aragon and Darrah (1) estimated income elasticities for different cereals. However, they focused only on the average income elasticity for the population as a whole. Two other studies were done with a similar focus, one by de Sagun (2) who did a cross-section analysis and another was done by Nasol (20) who did a time-series analysis. One more study was done by Madarbe (11) which shows income elasticity coefficients for various groups by income levels. The methodology used in that study, however, is not very clear. Moreover, as we will show, there is a sharp difference between the income elasticities reported by all the above studies and those we have estimated for the Philippines.

Our hypothesis is that the magnitude of income effect on change in consumption varies among different income classes. It is crucial to test this hypothesis for the Philippines since there is some evidence that distribution of income in the Philippines is highly inequitable (4, 12) and at the same time, malnutrition is widespread among the lower income population (18).

One cause of malnutrition is inadequate consumption of various foods due to low purchasing power. One needs to know how far income can be a key variable in alleviating malnutrition.

Many policymakers are becoming increasingly concerned that lower income people do not participate in the economic growth of low income countries. In this respect, Mellor and Lele (15, 9) argue that increased foodgrains production has the potential for large growth inducing linkages with other sectors of the economy. But sound planning for these linkages requires knowledge of the distribution of income from the foodgrain production technology and of the consumption pattern accompanying increased incomes of various socio-economic groups. The consumption side of this argument has been investigated in detail by Desai (3) for India. Using a similar methodology to Desai's, this paper will examine the consumption side of the Mellor-Lele argument for the rural and urban Philippines.

The paper is divided into the following sections. Section II describes the data, section III specifies the variables and demand functions. Section IV presents results and finally, the last section draws some policy implications from those results.

II. Data

The data were obtained from the 1971 survey on family income and family living expenditures conducted by the Philippine Bureau of Census and Statistics (6). The survey covered 4,199 urban and 7,460 rural households under a three-staged sampling design on a provincial level (6, p. xv). The family is the unit of observation and was defined as a group of persons usually living together and composed of the head and other persons related to the head by blood, marriage or adoption excluding those who are boarders, guests or domestic help. A person living alone was considered as a separate family.

For the purpose of analysis we consider the following five broad commodity groups reported in the survey (6, App.).

Serial number	Commodity group
1	Cereals and cereal products
2	Fish and other seafoods
3	Meat and eggs
4	Milk and dairy products
5	Roots, vegetables and fruits

The cereal category includes rice, corn, wheat and their products on the expenditure questionnaire. The traditional Filipino diet consists of rice

as the staple for the majority, and a "viand" or side dish which varies from meat or fish combinations for the upper income groups to small bony dried fish or vegetable leaf soups for low income families (19). In those regions where rice production is not possible, corn is eaten by the lower income groups but the higher income groups frequently substitute rice for less expensive corn (19). Thus, income effect on cereal consumption should reflect income effect on rice or corn.

Food expenditure data were gathered for a one week period and multiplied by 52 weeks. The family income reported was the aggregate income received or realized by family members during the past 12 months before the interviews. False reporting of income such as that from interest or extra jobs which is often forgotten, may result in serious errors of observation. Also, whereas income is considered to include current savings, total expenditures on all commodities, food as well as non-food items, may actually reflect the household's "permanent" income since they may be financed from current income, past savings and credit. Expenditures are greater than income for over half the income groups. Possible reasons for this include errors in sampling, recording of answers (especially because of the length of the interview), and the common finding that income and expenditure may frequently be over or underreported. For these reasons, expenditure elasticity of demand for a particular commodity group is the more relevant criterion for analyzing food consumption behavior by different income classes. Therefore the paper estimates expenditure elasticities.

Note that in the Philippines seasonality is likely to play a very important role in the availability of several consumer products, and cause variation in consumption of some commodities from season to season. However, we do not know the extent of such variability. The survey covered only consumption during May and June and therefore the applicability of the analysis to the remainder of the year is not known.

In order to understand the effect of varying family sizes on food expenditures, the average family size for each income group was computed from Table 25 published in the Survey (6). The average was computed by summing the percent of the population for each income group with 1, 2 and up to 10 persons per family and dividing by the number of persons in that income group for each family size. The family sizes computed by this method are given in Table 1.

III. Specification of Variables and Demand Functions

The independent variable in demand function is total household expenditure which is one general definition often used for household income. Apart from the total expenditure we also tried to see the influence of the family size on the patterns of consumption. There is considerable variation in family size, and therefore, family size is important to include in the demand function since larger families would be expected to have a relatively larger expenditure on food commodities.

Table 1. Total Expenditure, Family Size and Population by Income Groups: Rural and Urban, Philippines, 1971 1/

Income groups	Total expenditure		Family size		Population (%)	
Pesos	Rural	Urban	Rural	Urban	Rural	Urban
Less than 500	1607.02	1901.87	2.00	1.59	6.59	1.93
500 - 999	1986.56	2241.05	3.09	2.91	15.79	3.50
1000 - 1499	2405.85	2777.86	4.14	4.00	15.02	5.59
1500 - 1999	2820.64	3536.65	4.94	4.67	13.87	7.00
2000 - 2499	3225.34	3746.14	5.46	4.62	10.08	8.57
2500 - 2999	3597.78	4125.58	5.89	5.42	7.92	8.67
3000 - 3999	3923.79	4964.24	6.23	5.24	11.39	15.15
4000 - 4999	4743.94	5845.14	6.49	5.60	6.50	9.77
5000 - 5999	5486.47	6823.10	6.51	6.09	3.79	7.73
6000 - 7999	6506.45	8218.47	6.97	6.03	4.33	11.02
8000 - 9999	8099.50	9818.42	7.24	6.28	2.05	7.05
10000 - 14999	9090.03	12700.86	7.04	6.49	1.67	8.41
15000 - 19999	12849.16	17040.87	7.28	6.61	.43	2.72
20000 & above	12741.58	21841.24	7.40	7.01	.59	2.87

1/ Both income and total expenditure on all items are in per capita.

In the literature, several forms of the consumption demand function have been recommended on the basis of certain economic criteria. 1/ Out of those we fitted the following functional forms:

$$\ln Y = \alpha + \beta \ln X + \delta \ln Z + e \qquad \text{Double-log,} \qquad (1)$$

$$Y = \alpha + \beta \ln X + \delta \ln Z + e \qquad \text{Semi-log,} \qquad (2)$$

$$\ln Y = \alpha + \beta \ln X + \gamma / X + \delta \ln Z + e \qquad \text{Log-log inverse,} \qquad (3)$$

$$\ln Y = \alpha + \beta \ln X + \gamma X + e \qquad \text{Transcendental, and} \qquad (4)$$

$$Y/X = \alpha + \beta \ln X + \gamma / x + \delta \ln Z + e \qquad \text{Leser's form,} \qquad (5)$$

where, Y = expenditure on a particular commodity,

X = total expenditure of the household,

Z = family size,

e = residual (error term), and

$\alpha, \beta, \gamma \& \delta$ = parameters to be estimated.

Since we are using ordered grouped data, it is possible that the error term in the above equations may behave in a very specific way from one income group to the other. Prais and Aitchison (16) have shown that in such situations the error terms would be heteroscedastic unless each group has the same number of observations. Consequently the estimates for the grouped data become inefficient. To remove such heteroscedasticity from the estimation, each observation was weighted by using the square root of the population in each income group.

The best functional form was chosen on the basis of the coefficient of determination and standard errors of coefficients as the criteria. The expenditure elasticities were then computed for each income group, for different deciles of the population and for the sample as a whole by using the percentage of population in each income group as weights. The above analysis was done separately for rural and urban households.

IV. Rural and Urban Expenditure Elasticities

The consumption functions (1) to (5) were fitted by using Ordinary Least Squares method. Out of the five estimated functional forms, log-log inverse was selected for both rural and urban samples because the coefficient of determination was the highest for that form. Table 2 presents the estimates of the parameters for log-log inverse.

1/ See, for example, C.E.V. Leser (10).

Table 2. Estimated Log-Log Inverse Equations for Rural and Urban Philippines 1/

Dependent variable	Constant (α)	Explanatory variables: Total expenditure Log (β)	Total expenditure Reciprocal (γ)	Family size (δ)	$\bar{R}^2$
Cereal and cereal products					
Rural	6.58	.157	-1848.52	-.311	.999
	(.134)	(.010)	(75.347)	(.017)	
Urban	3.09	.396	441.80	.134	.990
	(.152)	(.012)	(105.45)	(.024)	
Seafood and fish					
Rural	5.16	.268	-2633.47	-.390	.994
	(.503)	(.038)	(283.4)	(.065)	
Urban	.911	.542	97.29*	-.322	.993
	(.229)	(.018)	(158.18)	(.035)	
Meat and eggs					
Rural	-1.20	.881	-1563.63	-.046*	.996
	(.660)	(.050)	(371.48)	(.085)	
Urban	1.76	.724	-3852.32	-.742	.995
	(.326)	(.025)	(225.681)	(.050)	
Milk and dairy products					
Rural	1.23	.537	-3795.52	-.111*	.992
	(1.25)	(.096)	(705.64)	(.161)	
Urban	.682*	.602	-2403.12	-.134*	.983
	(.529)	(.041)	(366.19)	(.082)	
Roots, fruits and vegetables					
Rural	1.486	.545	- 972.12	-.130*	.992
	(.614)	(.047)	(346.11)	(.079)	
Urban	-.626	.697	82.65*	.131	.989
	(.316)	(.025)	(218.44)	(.049)	

1/ Figures in parentheses are standard errors of estimates.

*Not significant at 1 percent level of significance.

The coefficients of total expenditure are all significant. The coefficients for reciprocal of total expenditure are also significant except for seafood and fish, and fruits and vegetables. This implies that the expenditure elasticities vary significantly among the income groups since the expenditure elasticity for log-log inverse at any income level is given by:

$$\text{expenditure elasticity} = \frac{\partial Y}{\partial X}\,\frac{X}{Y} = \beta - \frac{Y}{X} \qquad (6)$$

The influence of family size is also interesting to note. For the rural sector, the coefficient of family size is negative for all the food items. This implies that the larger the family size, the smaller is the per capita consumption of food in the rural areas of the Philippines. For the urban sector, however, the picture is mixed. For cereals and fruits and vegetables, the effect of family size on consumption is positive. Perhaps per capita consumption of cereals, fruits and vegetables is greater in large urban families because more family members have opportunity for employment and, therefore, with the extra income, the higher income families purchase large quantities of more expensive wheat products and fruits. 2/

Comparing rural and urban, it is evident that there is a considerable difference between rural and urban coefficients of the explanatory variables for all the commodities. This difference combined with the sectoral differences in total expenditure and population in different income groups implies that the average as well as the individual income groups have different expenditure elasticities in rural and urban sectors.

The above argument is supported by Table 3. There the expenditure elasticities for the bottom 40 percent and top 10 percent of the population have been computed. This was done as follows. First we computed cumulative frequency of population for each income group. Then the income groups were divided into 10 groups with each group containing 10 percent of the population. The expenditure elasticity for the bottom 40 percent is simply the weighted average of expenditure elasticities in the bottom four deciles with 0.25 as the weight for each decile.

The expenditure elasticities of cereals and seafood for urban, however show unreasonable trends. In those cases, the expenditure elasticities for the top 10 percent are greater than those for the bottom 40 percent. This contradicts the universal phenomenon that poor people spend more of their income than rich people on necessary items such as cereals.

Our estimates of expenditure elasticities for the urban sector, especially for the bottom 40 percent, seem biased. We found that bias might be due to the multicollinearity between family size and total expenditure. Therefore, the log-log inverse form was tried by taking total expenditure and expenditures on individual food items per unit of the family size for each income group. The regression fit, however, turned out to be extremely

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2/ Wheat products are largely imported in the Philippines.

Table 3. Expenditure Elasticities for the Lower 40 Percent and the Top 10 Percent of the Population (Effect of Family Size Incorporated)

Commodity	Rural		Urban	
	Lower 40	Upper 10	Lower 40	Upper 10
Cereal & cereal products	1.05	.41	.26	.37
Seafood & fish	1.53	.62	.48	.54
Meat & eggs	1.63	1.09	1.87	.97
Milk & dairy products	2.34	1.04	1.32	.75
Fruits & vegetables	1.01	.67	.67	.69

poor with R^2 of the order 0.10 and all the explanatory variables were statistically insignificant. So finally it was decided to omit family size as the explanatory variable in the consumption function.

Table 4 presents the estimates from log-log-inverse function without family size for both rural and urban Philippines. All the coefficients are significantly different from zero except for the reciprocal of total expenditure in cereals for urban. All the coefficients have reasonable signs with the negative sign for all the coefficients of the reciprocal of total expenditure. The expenditure elasticities decline significantly from one income group to the other (Tables 5 and 6).

But the inclusion of family size seems to be important in the rural sector because the variation in the elasticities estimated with and without the effect of family size is almost double for the rural sector while it is not significant for the urban sector. Furthermore, the income effect is considerably more in the rural sector. Also the effect of family size on total food expenditures in the urban sector was not significant (Table 2).

The urban expenditure elasticities are consistently lower than those for rural. The difference between the bottom 40 and top 10 percent of population is more in the rural sector than in the urban. Moreover, since the per capita total expenditure is higher in urban than in rural for all income groups we have further supporting evidence that the expenditure elasticities vary significantly across income groups. The variance across income groups is very similar to the variance that Desai found with the Indian data. Our expenditure elasticity estimates of 1.05 for cereals for the lower 40 percent and .41 for the upper 10 percent of the rural population are of the same order of magnitude (.93 and .37) as those for rural India (3, Table 3). In sum, we accept the hypothesis mentioned in the introduction of this paper that the magnitude of income effect on change in consumption does depend upon the income earned by the household.

Table 4. Estimated Log-Log Inverse Equations Without Family Size for Rural and Urban Philippines 1/

Dependent variables	Constant (α)	Explanatory variables: Total expenditure, Log (β)	Total expenditure, Reciprocal (γ)	$\bar{R}^2$
Cereal and cereal products				
Rural	4.237 (0.049)	0.331 (0.005)	- 505.419 (18.981)	0.998
Urban	3.806 (0.094)	0.351 (0.010)	- 97.293 (50.535)*	0.988
Sea food and fish				
Rural	2.222 (0.127)	0.486 (0.014)	- 950.461 (49.093)	0.994
Urban	2.626 (0.159)	0.436 (0.016)	-1195.896 (85.418)	0.989
Meat and eggs				
Rural	-1.543 (0.155)	0.907 (0.017)	-1366.248 (59.741)	0.997
Urban	-2.197 (0.285)	0.969 (0.029)	- 868.074 (152.404)	0.988
Milk and milk products				
Rural	0.893 (0.294)*	0.599 (0.032)	-3316.738 (113.526)	0.992
Urban	-0.032 (0.301)*	0.647 (0.031)	-1864.300 (160.945)	0.983
Fruits, vegetables and roots				
Rural	0.508 (0.145)	0.617 (0.016)	- 412.469 (55.957)	0.992
Urban	0.070 (0.182)*	0.654 (0.0188)	- 442.687 (97.366)	0.989

1/ Figures in parentheses are standard errors of estimates.

*Not significant at 1 percent level of significance.

Table 5. Expenditure Elasticity of Food and the Five Primary Food Groups for Rural and Urban Philippines (without the Effect of Family Size)

Income class (Pesos)	Cereal & cereal Products		Seafood & fish		Meat & eggs		Milk & dairy products		Fruits & vegetables	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Less than 500	.65	.40	1.08	1.06	1.76	1.43	2.66	1.63	.87	.89
500 - 999	.59	.39	.96	.97	1.59	1.36	2.27	1.48	.82	.85
1000 - 1499	.54	.39	.88	.87	1.47	1.28	1.98	1.3[illegible]	.79	.81
1500 - 1999	.51	.38	.82	.77	1.39	1.21	1.77	1.17	.76	.78
2000 - 2499	.49	.38	.78	.76	1.33	1.20	1.63	1.14	.74	.77
2500 - 2999	.47	.37	.75	.73	1.29	1.18	1.52	1.10	.73	.76
3000 - 3999	.46	.37	.73	.68	1.26	1.14	1.44	1.02	.72	.74
4000 - 4999	.44	.37	.69	.64	1.19	1.12	1.30	.97	.70	.73
5000 - 5999	.42	.37	.66	.61	1.16	1.10	1.20	.92	.69	.72
6000 - 7999	.41	.36	.63	.58	1.12	1.07	1.11	.87	.68	.71
8000 - 9999	.39	.36	.60	.56	1.08	1.06	1.01	.84	.67	.70
10000 - 14999	.39	.36	.59	.53	1.06	1.04	.96	.79	.66	.69
15000 - 19999	.37	.36	.56	.51	1.01	1.02	.86	.76	.65	.68
20000 & above	.37	.36	.56	.49	1.01	1.01	.86	.73	.65	.67
Weighted average	.51	.37	.82	.67	1.38	1.14	1.75	1.01	.76	.74

Table 6. Expenditure Elasticities for the Lower 40 Percent and the Top 10 Percent of the Population (Without the Effect of Family Size)

Commodity	Rural		Urban	
	Lower 40	Upper 10	Lower 40	Upper 10
Cereal & cereal products	.58	.40	.38	.36
Seafood & fish	.94	.61	.79	.51
Meat & eggs	1.56	1.09	1.23	1.03
Milk & dairy products	2.19	1.05	1.20	.77
Fruits & vegetables	.81	.67	.78	.68

Apart from expenditure elasticities it is also important to examine marginal propensity to expend (MPE) on different items. This is because, although the expenditure elasticities for some items such as meat and dairy products are high, their incremental share in incremantal expenditure might not be higher than that for cereals. The formula for computing MPE's for the Leser's form is as follows.

$$MPE = \frac{dY}{dX} = \frac{Y}{X} \left(\beta - \frac{Y}{X}\right) \qquad (7)$$

There is considerable variation in MPE's between the top 10 percent and the bottom 40 percent of the population, and also between rural and urban (Table 7). In both areas the bottom 40 percent spend substantially higher incremental total expenditure on cereals than the top 10 percent of population. And this expenditure on cereals is maximum among all food items for the bottom 40 percent of population. In contrast, the top 10 percent of population spends the maximum incremental expenditure on meat and eggs. Such differences in incremental expenditure are further magnified if one compares the bottom 40 percent of rural population with the top 10 percent of urban population.

Table 7. Marginal Propensity to Expend for the Lower 40 Percent and Top 10 Percent of the Population (Without the Effect of Family Size)

Commodity	Lower 40 percent		Top 10 percent	
	Rural	Urban	Rural	Urban
Cereal & cereal products	.1772	.0774	.0593	.0442
Fish & other seafood	.1002	.0714	.0459	.0432
Meat & eggs	.0791	.0702	.0758	.1132
Milk & dairy products	.0271	.0333	.0259	.0312
Fruits & vegetables	.0562	.0395	.0313	.0365

V. Policy Implications

This study finds that the size of income effect on food consumption varies considerably among income groups as well as between rural and urban areas in the Philippines. The expenditure elasticities estimated are much higher than the income elasticities argued by the earlier studies done on the Philippines. With cross-sectional data, expenditure elasticities are of the same order as income elasticities. These high expenditure elasticities for the lower 40 percent of the rural population show that there is a great demand for food commodities among lower income rural families as compared to high income familes. In other words, with increased income, the poor have a higher demand for food than the rich.

Cereals are the main source of calories for low income families. When calorie intake is inadequate, protein is metabolized by the body for energy thus making protein intake insufficient to meet bodily needs. Broadly speaking, animal food products provide good quality protein plus vitamins and minerals. Nutritionally adequate amounts of protein can be consumed when the incomplete protein of cereals is improved in quality by consuming complementary animal and legume protein. In the Philippines, milk and dairy products and meat and eggs have expenditure elasticities of 1.63 and 2.34, respectively, for the lower 40 percent of the rural population. These elasticities indicate that these foods are "luxury goods" to the rural population. On the other hand, seafood, fruits and vegetables are necessities (income elasticities are less than 1) and can work as an economic source of food which complements the staple cereals nutritionally. 3/ In particular, with an unit increase in total expenditure the bottom 40 percent of the population would spend more on cereals and seafood than on fruits and vegetables, meat and eggs, and milk and dairy products. The top 10 percent, in contrast, would spend maximum incremental income on meat and eggs. This indicates that nutritional policies should be set differently for poor and rich people in the Philippines.

The average income elasticity for cereals and cereal products is around 1.05 for the bottom 40 percent of the rural population. Since rice consumption constitutes on an average 70 percent and in some regions 100 percent of the cereal consumption, one would expect the expenditure elasticity of demand for rice to be of the order of at least 0.4 for the lower 40 percent of the population in the rural sector. However, the estimates cited in the works of Aragon, Darrah, de Sagun and Madambe and Nasol are of the order 0.06 (average), which are markedly below what we have found. The projections of demand for cereals, especially for the important staple rice, would be different for the two different estimates of income elasticities. Of course, if the real per capita income remains constant and if the income distribution does not change over time, the rate of growth of demand for cereals will be proportional to population growth. But in the context of growth and lessening income disparities, the projection of demand for rice will be much higher with our estimates of expenditure elasticity than those cited in the past literature.

3/ Pulses are included in the fruits and vegetables category but are consumed in relatively small amounts in the Philippines.

The short run implications of our estimates are also important to note. Using the budget share and the income elasticity, the price elasticity of a particular commodity can be computed. In particular, if one assumes the price elasticity of demand for substitutes is zero, then the price elasticity of demand for cereals, as an example, can be given as follows:

Price elasticity = (budget share x income elasticity)

Then the price elasticity of cereals, of which rice is the major counterpart, will be of the order of 0.2 for the lower 40 percent. If one uses the earlier estimates, the price elasticity of demand for cereals will be almost zero. The effects of price change on consumption through the income effect would thus be different for the lower 40 percent and the top 10 percent of the population. This has important nutritional and economic implications, especially when there is a shortage of particular cereals, such as rice. Economically, poor families face an increased income constraint. With this income constraint, how is the nutritional adequacy of their diets affected? Since there will be a greater percentage decline in cereal expenditures for the lower income groups as compared to the higher income deciles and given the minimal initial consumption in the lower income deciles, the risk of malnutrition among the low income families is high. 4/

The implications of our expenditure elasticity estimates of cereals on demand for rice should be used with caution. For example, in the event of a rice shortage, it is quite likely that the lower income groups might substitute corn for rice as the rice price increases. At this stage, we do not know the relative quantities of foods which complement corn nutritionally, such as beans, meat and fish, that would be consumed given the income constraint. Therefore, it is difficult to predict the nutritional adequacy of diets of people substituting corn for rice. In this respect, some further research is needed. However, at least in terms of preferences, consumers prefer rice to corn and so in substituting corn for rice some disutility is certainly involved.

4/ See John W. Mellor (13) for detailed discussions of this issue for the Indian economy.

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