FLEXIBLE FUNCTIONAL FORM ESTIMATES OF PHILIPPINE DEMAND ELASTICITIES FOR NUTRITION POLICY SIMULATION

Ma. Agnes R. Quisumbing
Teresita E. Valerio
Evangeline R. Red
Gracia M. Villavieja

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FLEXIBLE FUNCTIONAL FORM ESTIMATES OF PHILIPPINE DEMAND ELASTICITIES FOR NUTRITION POLICY SIMULATIONS*

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CHAPTER I

INTRODUCTION

An analysis of the consumption and nutrition effects of food policies relies heavily on estimates of demand parameters. Since the distributional consequences of market intervention policies are of vital concern to food policy analysts, income-stratum-specific demand parameters have become an essential input into such analyses. Given the importance of these disaggregated parameters, the estimation methodology has likewise attracted much attention in recent years.

Income-group-specific parameter estimation has been justified on the grounds that substantial differences in consumption behavior exist at different income levels. furthermore, even when compensated for the income effects of the price changes, the pure substitution, or Slutsky, elasticities,

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**Dr. Quisumbing is an Assistant Professor at the School of Economics, University of the Philippines while the three other co-authors are Science Research Specialists at the Food and Nutrition Research Institute.

are likely to be greater for low income groups. This has led Timmer (1981) to suggest that an income-related "curvature" of the Slutsky matrix exists.

Models used to estimate differential impacts of intervention policies typically use separate demand functions for each consumer stratum. Though the model structures differ -- there are partial equilibrium models (e.g., Pinstrup-Andersen et al. 1976, 1978; Perrin and Scobie, 1981; Gray, 1982), as well as general equilibrium models (Disch, 1984; McCarthy and Taylor, 1980)-- a set of income-group specific demand parameters is common to all.

One major problem in demand parameter estimation is the choice of an appropriate functional form which is both consistent with demand theory and sufficiently flexible as to allow ease of estimation without the imposition of unrealistic restrictions which artificially constrain the range of the parameters. Apart from the choice of functional form, appropriate methods for treating cross-section data must be considered. While cross-section data provide a wealth of information on a level of disaggregation seldom found in time-series studies, they have often yielded widely disparate estimates depending upon the particular assumption chosen by the researcher.

This paper attempts to address both problems by applying duality theory to the estimation of disaggregated demand parameters using flexible functional forms as well as incorporating methods for treating zero observations in household survey data. The paper is organized as follows: Chapter II provides a review of consumer theory and demand systems; Chapter III discusses econometric issues involved in using household level data; Chapter IV reviews Philippine demand elasticity estimates; Chapter V presents the empirical specification of the two demand systems in this study--one for food, and one for five expenditure groups; and Chapter VI analyzes the results of the estimation procedure. Chapter VII presents the results of simulations of food policy interventions using the estimated parameters, and finally, Chapter VIII presents the concluding remarks.

CHAPTER II

CONSUMER THEORY AND DEMAND SYSTEMS

Complete demand systems can be derived in two ways: (1) maximizing a utility function subject to a budget constraint, or (2) applying duality theory to obtain demand functions from the first derivative of a cost (or expenditure) function. In the first case, we obtain Marshallian demand functions in nominal prices and incomes; in the second, Hicksian (compensated) demand functions in nominal prices and real income.

2.1 Utility Maximization.

The individual consumer is said to maximize a utillity function $u = u(q)$ subject to a budget constraint $p'q = y$, where $q = (q_i)$ is an n-element column vector of quantities bought, p is a column vector of prices, and y is total income (or total expenditure). Assuming that the utility function is monotonic and twice-differentiable, and that the Hessian matrix of second partial derivatives $H = \frac{\partial^2 u}{\partial q_i \partial q_j}$ is symmetric, maximization using a Lagrangean function results in a system of $n + 1$ equations given by

$$(2.1) \quad \frac{\partial u}{\partial q_i} = \lambda P_i \quad \text{and} \quad p'q = y_n$$

where λ is the Lagrangean multiplier. Solving the $n + 1$

equations simultaneously for $_0q$ in terms of p yields a system of demand equations, $q = q(Y,P)$. The demand systems should also satisfy the following restrictions: (1) homogeneity of degree zero in incomes and prices; (2) negative definiteness and symmetry of the Slutsky substitution matrix, and (3) share-weighted sum of income elasticities equal to 1.0.

The imposition of restrictions in empirical applications not only assumes that the estimated parameters will satisfy the axioms of consumer theory but also reduces the number of parameters to be estimated from $n(n + 1)$ to $(n - 1)(\frac{1}{2} n + 1)$ if the three conditions are applied simultaneously.

The Linear Expenditure System. One of the first attempts to derive an empirical demand system which satisfied all restrictions was the Linear Expenditure System (LES) (Stone, 1954). Stone writes a general formulation for demand as

$$(2.2) \quad p_i q_i = \beta_i Y + \sum_{j=1}^{n} \beta_{ij} P_j$$

The only form of (2.2) which satisfied the restrictions of adding-up, homogeneity and symmetry is the LES

$$(2.3) \quad p_i q_i = p_i \gamma_i + b_i (Y - \sum p_k \partial_k)$$

with $\sum b_i = 1$. The γ_i are often interpreted as minimum or subsistence quantities, while $(Y - \sum p_k \gamma_k)$ is supernumerary expenditure, allocated according to the fixed proportions b_i after subsistence requirements have been met.

Samuelson (1947) and Geary (1950) have shown that (2.3) is derived from a utility function of the form

$$(2.4) \quad u(q) = f\{\sum_{i=1}^{n} \beta_i \log(q_1 - \gamma_i)\} \quad \text{or}$$

$$(2.5) \quad u(q) = \prod_{i=1}^{n} (q_i - \gamma_i)^{\beta_i}$$

Since u_i can be written as a transformation of an additive utility function,

$$(2.6) \quad S_{ij} = \phi \; Y \frac{\partial q_i}{\partial Y} \cdot \frac{\partial q_j}{\partial Y} \qquad i \neq j$$

So, from the actual demand equations we can calculate, for $i \neq j$

$$(2.7) \quad S_{ij} = \frac{b_i b_j}{P_i P_j} (Y - p'\gamma) \quad \text{and thus}$$

$$\Phi = - \frac{(Y - p'\gamma)}{Y}$$

If S is to be negative semidefinite, S_{ij} must be negative for all pairs of goods; thus complementarity is ruled out. In addition, inferior goods cannot exist. Calculating elasticities from (2.3), we have

$$(2.8)\quad E = \Phi^{-1}b$$

$$e_{ij} = -b_i \frac{p_j \gamma_j}{p_i q_i} \qquad i \neq j$$

$$e_{ii} = -1 + (1 - b_i) \frac{\gamma_i}{q_i}$$

All goods which are price elastic will have parameters less than zero. For $\gamma > 0$, goods must therefore be price inelastic. The restrictiveness of relationship imposed within the system, particularly the negation of complementarity and the inelasticity of price coefficients, has led to the formulation of other demand systems.[2]

The S-Branch System. One generalization of the LES which allows complementary and independent relationships as well as substitutability is the S-branch system (Brown and Heien, 1972; Heien, 1982). In addition, the own-price elasticity can range from 0 to $-\infty$.

Consider the consumer who ranges his consumption set into S branches. The subutility function for a branch, composed of various goods q_{si}, is:

$$(2.9)\quad U_s = \left(\sum_{i=s}^{n_s} \beta_{si} q_{si}^{\rho_s}\right)^{1/\rho_s}$$

where $\rho_s = \frac{1}{1 - \sigma_s}$ is the Allen elasticity of substitution (AES) between goods in the Sth and n_s is the number of goods in that branch. These subgroups can then be aggregated into an overall utility function

$$(2.10) \quad u = \left(\sum_{s=1}^{S} \alpha_s u_s^{\rho} \right)^{1/\rho}$$

where S , refers to the total number of groups and $\sum_{s=1}^{S} n_s$ is the total number of goods. Maximization of (2.10) subject to the budget constraint yields demand functions of the form:

$$(2.11) \quad q_{si} = (\beta_{si}/P_{si})^{\sigma_s} \alpha_s^{\sigma} X_s^{-1} Z_s M_m$$

where

$$(2.12) \quad X_s = \sum_{i \varepsilon s}^{n_s} (\beta_{si}/P_{si})^{\sigma_s} P_{si}$$

$$(2.13) \quad Z_s = \alpha_s^{\sigma} X_s \left(\frac{\sigma - 1}{\alpha_s - 1} \right)$$

$$(2.14) \quad M = \sum_{r=1}^{s} Z_r$$

$$(2.15) \quad m = \sum_{S=1}^{s} \sum_{\substack{s \\ j \varepsilon s}}^{n_s} P_{sj} q_{sj}$$

Brown and Heien (1972) show that all intergroup pairs are substitutes, but that intragroup pairs may be either substitutes or complements. Giffen paradoxes and inferior goods are both ruled out from the S-branch system.

In practice, the empirical performance of the S-branch system may well depend upon the grouping of the commodities and the plausibility of a common elasticity of substitution between and within subgroups. Quisumbing's (1985) results do not show that this assuption is warranted with a detailed breakdown of food commodities.

Approaches using the LES and additivity in general have been criticized by Brown and Deaton (1972) and Timmer (1981), among others. Brown and Deaton (1972:1197) point out that if variations in real income are larger than variations in relative income, the linear expenditure system, like other additive models, will impose a structure on estimated price effects largely independently of actual price effects, and will not measure price responses. This is usually true for long time series of broad commodity groups as well as for multiperiod budget data. Timmer (1981) also states that additivity may not be warranted for disaggregated food commodities since substitution between nutrient sources of different costs is quite significant.

Other Approaches. Other system approaches include the Frisch (1959) method, which requires an estimate of the marginal utility of money income, income elasticities and budget shares to compute price and cross-price elasticities, and the Betancourt (1971) procedure, which utilizes variation of wage rates across income classes as a proxy for income-stratum-specific variation in the price of leisure. Both of these approaches attempt to compute price elasticities in the absence of cross-sectional variation in commodity prices. These have also been criticized due to the assumption of want-independence (or additivity of the utility function) which is imposed in order to obtain the computational formulae (Brown and Deaton, 1972; Timmer, 1981).

Other approaches to consumer demand have used "pragmatic" approaches and imposed no a priori restrictions, or imposed them only where empirically valid.[3] Unfortunately, the use of such approaches will imply that the demand equations will satisfy the axioms of consumer theory only on an ad hoc basis. Fortunately, recent developments in duality theory permit the estimation of demand parameters from functional forms which (1) allow sufficiently flexible response; (2) satisfy the three axioms of consumer theory; and (3) are computationally convenient. This is discussed in the next section.

2.2 Duality in Consumer Theory and Flexible Functional Forms.

The application of duality theory to consumer demand permits us to establish a one-to-one correspondence between the direct utility function $u(x; y)$, where maximum utility U is derived from consumption of x subject to the budget constraint y; the expenditure function $e(p; u)$ which minimizes the cost of attaining utility level u at prices p; and the indirect utility function $v(p, y)$ which maximizes utility given p and y.[4]

Given an indirect utility function $v(p, y)$, if $v(p, y)$ is strictly increasing in y, we can solve for y as a function of U to derive the expenditure function $e(p, u)$. Applying Roy's identity to the indirect utility function yields Marshallian demand functions in nominal income and prices, i.e.,

$$(2.16) \quad X_i(p, y) = -\frac{\frac{\partial V(p, y)}{\partial P_i}}{\frac{\partial V(p, y)}{\partial Y}} \qquad \text{for} \quad i = 1, \ldots, n$$

assuming that the right hand side is defined and $p >> 0$.

Differentiation of the expenditure function $v(p; v)$, on the other hand, yields Hicksian (compensated) demand functions with prices and real income as explanatory variables, i.e.,

$$(2.17) \quad h_i(p; u) = \frac{\partial e(p; u)}{\partial P_i} \qquad \text{for} \quad i = 1, \ldots, n$$

assuming that the derivative is defined and $p >> 0$.

Recall that the demand functions must fulfill the following conditions:

1. homogeneity of degree zero in income and price
2. symmetry of the compensated cross-price terms
3. weighted sum of income elasticities equal to 1

Homogeneity of degree zero is assured if the indirect utility function is linearly homogeneous in prices p; while symmetry of compensated cross-price terms follows from Young's theorem as applied to the indirect utility function, i.e., assuming utility maximization.

$$(2.18)\quad (\partial^2 v^*)/(\partial P_i \partial P_j) = \partial X_i^*/\partial P_j = \partial X_j^*/\partial P_i$$
$$= (\partial^2 v^*)/(\partial P_j \partial P_i) \iff v_{ij}^* = V_{ji}^*$$

Adding-up follows due to maximization subject to a linear budget constraint.

In empirical work, the above mentioned restrictions are more easily imposed on Hicksian demand functions in real income and prices due to the difficulty of imposing cross-equation symmetry restrictions on Marshallian demand functions, which have uncompensated price coefficients. Swamy and Binswanger (1983) point out that the use of real income in Hicksian demand functions is dependent upon the definition of a suitable deflators if the consumer's utility function is unknown. They use Diewert's (1976) result that if the cost (or indirect utility) function is unknown but is approximated by a flexible functional form,[5] then certain index numbers can be estimated which, when used to deflate nominal income, provide changes in real income that correspond exactly to changes in utility levels. Diewert has shown that any quadratic mean of order r quantity index can approximate an arbitrary non-homogeneous utility function to the second degree and that any quadratic mean of order r price index can similarly approximate an arbitrary cost or indirect utility function. Swamy and Binswanger use chained Fischer's indices in their study, since, among the quadratic means of order r index numbers, Fischer's quantity and price indices are computationally convenient and satisfy the factor reversal test. Pitt (1982) uses Stone's index $\tilde{P} = \exp(\sum w_k \log p_k)$, which is also used by Deaton and Muellbauer (1980a) as an approximation to a "true" price index in the Almost Ideal Demand System (AIDS). Deaton and Muelbauer (1980a) note that the $\tilde{P}$ approximation would be close if prices were closely collinear.

Three functional forms which have been commonly used in empirical applications are the normalized quadratic (NQ), generalized Leontief (GL) and translog (TL) demand functions, which are derived from their corresponding cost or expenditure functions (from Swamy and Binswanger, 1983:676-677).

Normalized Quadratic Demand Functions (NQ).

The normalized quadratic demand function can be written as:

$$(2.19)\quad X_i = a_i + b_{i1}m + b_{i2}m^2 + \sum_{j=1}^{N-1} C_{ij}(P_j/P_N) \qquad i = 1, \ldots, N-1$$

$$X_N = a_N + b_{N1}m + b_{n2}m^2 + 0.5 \sum_{i=1}^{N-1}\sum_{i=1}^{N-1} C_{ij}(P_iP_j/P_N^2)$$

where P is the price index of all commodities, $m = M/P$ is real income, and C_{ij} are the price coefficients. Note that the equations are normalized by dividing by the price of the n^{th} good, thus homogeneity is imposed and cannot be tested. The symmetry constraints are:

$$(2.20)\quad \frac{\partial X_i}{\partial P_N} = -\sum_{j=1}^{N-1} C_{ij} \frac{P_j}{P_N^2} = \frac{\partial X_N}{\partial P_i} = \frac{C_{Ni}}{P_N} \qquad i \neq N$$

and

$$(2.21)\quad c_{Ni} = -\sum_{j=1}^{N-1} C_{ij} \frac{j}{P_N} \qquad i = N$$

which can be imposed by substituting (2.21) on the RHS of the N^{th} equation (2.19). The adding up constraint

$$(2.22)\quad \sum_i \frac{P_i}{\tilde{P}_i} (b_i\,1 + 2b_{i2}m) = 1$$

can be immposed only for given sample points, usually sample means.[6]

One advantage of the NQ demand system is that the N^{th} quantity can be estimated residually, so long as its price is given, using adding up. Another advantage of the NQ system is its relatively simple expressions for demand elasticities, since only single coefficients are used. This is less subject to error if econometric estimates of the price coefficients are not very reliable. The elasticity formulae for the NQ are:

$$(2.23) \quad \eta_{ii}^{C} = C_{ii} \frac{P_i}{X_i P_n} \qquad i < N \qquad \text{(OPE)}$$

$$(2.24) \quad \eta_{NN}^{C} = -\sum_{j=1}^{n-1} C_{Nj} \frac{P_j}{P_N X_N} \qquad \text{(OPE)}$$

$$(2.25) \quad \eta_{ij}^{C} = C_{ij} \frac{P_j}{X_i P_N} \qquad ij < N, \; i \neq j \qquad \text{(CPE)}$$

$$(2.26) \quad \eta_{iN}^{C} = -\sum_{j=1}^{N-1} C_{ij} \frac{P_j}{X_i P_N} \qquad i < N \qquad \text{(CPE)}$$

$$(2.27) \quad \eta_{im} = \frac{1}{X_i} b_{i1} m + 2 b_{i2} m^2 \qquad \text{all } i \qquad \text{(Income)}$$

Generalized Leontief Demand Functions (GL)

Similarly, the generalized Leontief demand functions can be expressed as:

$$(2.28) \quad X_i = a_i + b_{i1} m + b_{i2} m^2 + \sum_{j \neq 1} C_{ij} \left(\frac{P_j}{P_i}\right)^{\frac{1}{2}} \qquad i = 1, \ldots, N$$

Homogeneity of degree zero is imposed and cannot be tested, while symmetry implies that $C_{ij} = C_{ji}$ and is imposed for all sample points. The adding up constraint is the same as for NO. Below, we present the expression for the elasticities.

$$(2.29) \quad \eta_{ii}^{C} = \frac{-1}{2X_i} \sum_{j=1} C_{ij} \frac{(P_j)^{1/2}}{P_i} \qquad \text{all} \quad i \quad \text{(OPE)}$$

$$(2.30) \quad \eta_{ij}^{C} = \frac{1}{2X_i} C_{ij} \frac{(P_j)^{1/2}}{P_i} \qquad \text{all} \quad i, j \quad i \neq j \quad \text{(CPE)}$$

$$(2.31) \quad \eta_{im} = \frac{1}{X_i} b_i^{m} + 2b_{i2}m^2 \qquad \text{all} \quad i \quad \text{(Income)}$$

Note that the expression for the own-price elasticity is a sum of terms, or separately estimated coefficients. This may be quite sensitive to right hand side variables which are left out or incorrectly measured.

Transcendental Logarithmic Demand Function (TL)

Finally, the transcendental logarithmic (translog) demand function is

$$(2.32) \quad S_i = a_i + b_{i1}\log m + b_{i2}(\log m)^2 + \sum_{j=1}^{N} C_{ij} \log P_j$$

$$i = 1, \ldots, N - 1$$

where $S_i = X_iP_i / \sum_{i=1} X_iP_i$; or the expenditure share of commodity i. Homogeneity of degree zero implies that $\sum C_{ij} = 0$ for all i can be tested and imposed. Symmetry implies that $C_{ij} = C_{ji}$ and can be imposed at all sample points. Since shares add up to one, $N - 1$ equations are linearly independent and one equation must be dropped for estimation purposes. Thus, adding-up cannot be tested and is maintained hypothesis.

The elasticities for the TL demand system are given by:

$$(2.33)\quad \eta_{ii}^{C} = \frac{C_{ii}}{S_i} + S_i - 1 \qquad i < N \qquad \text{(OPE)}$$

$$\eta_{NN}^{C} = \frac{\sum_{i=1}^{N-1} \sum_{j=1}^{N-1} C_{ij}}{S_N} + S_N - 1 \qquad \text{(OPE)}$$

$$(2.34)\quad \eta_{ij}^{C} = \frac{C_{ij}}{S_{ji}} + S_j \qquad i, j < N, \; i \neq j \qquad \text{(CPE)}$$

$$\eta_{iN}^{C} = \frac{-\sum_{j=1}^{N-1} C_{ij}}{S_i} + S_N \qquad i < N \qquad \text{(CPE)}$$

$$(2.35)\quad {}_{im} = \frac{b_i1 + 2b_i2 \log m}{S_i} + 1 \qquad i < N \qquad \text{(Income)}$$

$$\eta_{Nm} = \frac{1 - \sum_{i=1}^{N-1} S_i \, \eta_{im}}{S_N} \qquad \text{(Income)}$$

Since the translog is expressed in terms of budget shares, one empirical advantage is being able to estimate elasticities for the N^{th} equation provided that price data on the N^{th} good are available. For example, if the missing category is nonfood, then one can estimate nonfood price and cross-price elasticities given nonfood price data. One disadvantage, which will be discussed in the next section, is its unsuitability to the tobit estimation procedure.

Bantilan's (1986) paper points out the limitations of using Taylor's series expansions as approximations to a more general functional form. However, the computational advantages--linearity in parameters, economy in the number of parameters to be estimated--as well as the dubious gains in using a more complicated estimation procedure when data are not of uniformly good quality justify the use of the above-mentioned functional forms in this study.

CHAPTER III

SOME ECONOMETRIC ISSUES INVOLVED IN CROSS-SECTION ESTIMATION

Because of the scope for disaggregation by income and other household characteristics, cross-section data have been widely used for estimating income-stratum-specific demand parameters. The use of cross-section data has its corresponding set of estimation and interpetation issues. This paper reviews only a selected number and does not claim to be exhaustive. Before discussing the specifics of estimation, it is perhaps appropriate to begin with differentiating estimates obtained from time-series versus cross-section data.

First, demand elasticities estimated from household survey data refer to household consumer demand, and thus do not include industrial demand for materials and intermediate inputs and farm demand for feed. Second, elasticities estimated from cross-section data typically will reflect long-run adjustments of households to regional differences in prices and to expected seasonal price movements, whereas annual time series will tend to reflect shorter run reaction (Timmer, 1982; Kuh, 1959).

> "... higher cross-section slope estimates can be interpreted as long-run coefficients. The fully adjusted response will typically show a higher coefficient than an incompletely adjusted response. Since the cross-section data will also contain some short-run disturbances, however, these coefficients will

> only approximate fully adjusted long-run coefficients" (Kuh, 1959:197).

Thus, elasticities obtained from annual time-series are expected to be smaller in absolute value than cross-section estimates.[7] It is important to ascertain the numerical value of differences between time-series and cross-section estimates: as Kuh (1959) points out, if the time-series estimate is some function of the typical cross-section estimate, one estimate can be translated into the other irrespective of the casual factors that determine the discrepancy. Unless this relationship has been systematically established, however, cross-section estimates cannot be used successfully to make time-series predictions. In the remainder of this section, we discuss some of the econometric issues which are significant in the use of household level data, namely (1) allowing for income-varying parameters and (2) the treatment of households observing non-zero consumption.

3.1 Income Stratum Specific Demand Elasticities.

Three methods have been commonly used to allow for the variation of demand elasticities across income classes: (1) stratifying the sample into subgroups and estimating separate parameters for each subgroup; (2) using dummy variables (slope and intercept shifters) for each subgroup; and (3) introducing an income-varying term into the regression equation. Researchers with sufficiently large data sets usually apply the first method, stratifying the sample according to some pre-defined criterion, e.g., percentile points in the income or calorie distribution, rural-urban classification, or occupation grouping, while those with smaller data sets introduce income-varying parameters through a squared income term (Swamy and Binswanger, 1983), through structural equations relating parameters to income (Pitt, 1983) or through piecewise regression. The use of dummy variables is probably conditional upon the assumption of a constant variance-covariance matrix for the entire sample; if the data are heteroscedastic (as is expected in cross-section data), splitting the sample would be a preferable procedure since one would not have to impose the same underlying variance-covariance matrix.

The use of the squared income terms is fairly popular and is used to allow income elasticities to vary across income groups (Swamy and Binswanger, 1983; Pitt, 1983; Gray, 1982). Swamy and Binswanger probably express undue concern regarding the deviation of this form from the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980). They argue that since the budget constraint is a linear function, introducing a squared term will create non-linearities. However, all that the linear budget constraint requires is $\sum p \cdot X(p, y) = Y$ regardless of the form that $X(p, y)$ should take. That is, it is possible for $X(p, y)$ to be nonlinear in Y and still satisfy the budget constraint.[8] The possible drawback of using the squared income term is that it may not allow for variation in the price elasticities unless income varying terms are specified in a separate equation. This is the case in demand equations which are functions of real income and nominal prices. Note that in the TL, NQ and GL, price elasticities are computed from the price coefficients alone. Thus, introducing a squared income term will allow compensated income elasticities to vary, but not the Slutsky elasticities. This may not be desirable if there in fact exists an income-related "curvature" of the Slutsky matrix.

One can also test whether splitting the sample is equivalent to a single regression with income varying parameters by performing a model selection test. Most studies which estimated separate sets of parameters have not done this. For example, Gray (1982) justified the estimation of separate sets instead of using dummy variables for separate income groups by citing the adequate number of degrees of freedom and the imposition of the same underlying variance-covariance matrix if the equations were estimated together. If the criterion used to split the sample is a continuous variable, e.g., income, it may be advisable to test for equality of variance first before estimating separate regressions since it may be desirable to have parameters which do not exhibit discontinuities once the threshold income is reached. However, if the criterion variable is qualitative (e.g. occupation or location) avoiding discontinuities is no longer relevant. In any case, the issue of model selection is an area which deserves further attention.

3.2 Limited Dependent Variables: The Case of Nonconsuming Households.

Another related econometric issue is the treatment of households which do not report positive consumption of a commodity. Regional taste differences, seasonality, or regional differences in availability among others, may be reasons for zero consumption. Another, of course, is that lower income households will not be able to afford consumption of some commodities at prevailing prices. Dropping households reporting nonzero consumption not only reduces the sample size but also creates a truncation bias since those households are part of the market but do not choose to consume, whereas using OLS techniques on transformed variables (e.g., variables to which a positive number has been added to avoid indeterminate results in logarithmic models) or semi-log models will result in inconsistent and biased estimates because the assumptions underlying the classical regression model do not hold. An appropriate estimation procedure to use is Tobin's (1958) limited dependent variable model, since it permits a positive probability of observing nonconsumption.

The stochastic model underlying tobit is given by the following relationship:

$$(3.1)\quad Y_t = X_t\beta + u_t \quad \text{if} \quad X_t\beta + u_t \geq 0 \qquad t = 1, 2, \ldots, n$$
$$\qquad\qquad = 0 \quad \text{if} \quad X_t\beta + u_t < 0$$

where n is the number of observations, Y_t is the dependent variable, X_t is a vector of independent variables, β is a vector of unknown coefficients and u_t is a normally and independently distributed error term, $u_t \sim N(0, \sigma^2)$. Tobit models immediately rule out certain functional forms. Pitt (1983) shows that if expenditure share is the dependent variable in a tobit demand model and if demand is inelastic, an increase in the own-price implies an increase in the probability of consuming (positive) quantities of the commodity. Novshek and Sonnenchein (1979) have shown that such a response on the part of marginal consumers is inconsistent with neoclassical demand theory. They argue that when considering the demand for differentiated products (e.g., food), price induced changes in market demand are decomposed into income (I), substitution (S), and change-of-commodity (C) effects. By neoclassical theory, (S) is negative. Thus, even if individual demand functions are upward sloping, (S) will guarantee that market demand for a commodity must slope downward whenever there are differentiated commodities which are sufficiently close to the commodity in question (Novshek and Sonnenchein, 1979:1375). As Pitt points out, in the tobit model, the probability of consuming is given by the normal cumulative function evaluated at the expected value of the unobserved latent variable $y^*_t = X_t\beta + u_t$. Since expenditure, and therefore $E(y^*_t)$ is an increasing function of own-price if demand is inelastic, the probability of consumption rises with own-price even if expected demand will normally fall.

Because tobit models are estimated using maximum likelihood methods, it is also desirable to use functional forms which are linear in the parameters to be estimated for ease of estimation. Having ruled out translog models,[9] we can use other flexible form demand functions. However, since a multivariate tobit package is not available, this study is limited to single-equation tobit techniques. Thus we do not use the normalized quadratic or generalized Leontief, but the simple functional forms used by Pitt (1983) with subsequent modifications which will be discussed in Chater V.

The use of the tobit models permits the decomposition of the market elasticity of demand (e_i) into two components: (1) elasticity of the probability of consumption with respect to X_i, or the participation elasticity (e_i^P), and (2) the elasticity of the expected consumption of consuming households with respect to X_i, or the nonlimit consumption elasticity (e_i^N) (Pitt, 1983; following Thraen, Hammond and Buxton, 1978).

In the tobit model (3.1), the expected value of the dependent variable y is given by

$$(3.2)\quad E(y) = \sigma z F(z) + \sigma f(z)$$

where $z = XB/\sigma$, $F(\ )$ is the normal cumulative distribution function and $f(\ )$ is the unit normal density. The elasticity of $E(y)$ with respect to X_i is

$$(3.3)\quad e_i = \frac{\partial E(y)}{\partial X_i} \cdot \frac{X_i}{E(y)} = \sigma(\partial z/\partial X_i)F(z)\ X_i/E(y),$$

which can be decomposed as

$$(3.4)\quad e_i = \frac{\partial F(z)}{\partial X_i} \cdot \frac{X_i}{F(z)} + \frac{\partial E(y)}{\partial X_i} \cdot \frac{X_i}{E(\tilde{y})} = e_i P + e_i n$$

where $E(y) = E(y)/F(z)$ is the expectation of y for $y > 0$. While it is impossible to perform an elasticity decomposition with time-series data, cross-section data and the use of the tobit model permit us to estimate both limit and nonlimit adjustments to price and income changes.

CHAPTER IV

PHILIPPINE DEMAND ELASTICITY ESTIMATES: A REVIEW

A number of studies have attempted to estimate demand parameters from Philippine data. These studies vary according to methodology, degree of commodity aggregation, type of data, and sample stratification. This paper focuses on the methodological aspects of the abovementioned studies and concentrates only on those for which comparable estimates are available. It therefore does not include earlier work estimating demand functions for single commodities. It also chooses to highlight the studies on food demand which constitute the bulk of Philippine consumption studies. A more exhaustive review of staple food consumption studies in the Philippines is found in Bennagen (1982). Table 1 presents elasticity estimates for selected items from some of the studies reviewed in this paper; a more complete compilation is found in Quisumbing (1986).

4.1 Data Sources and Methodology.

Earlier demand studies used aggregate time-series data to estimate demand functions. Among these is Pante's (1971) estimation of alternative static and dynamic demand functions for four commodity groups (food, beverages and tobacco, durables, and miscellaneous) using time-series data from 1949 to 1974. A major

Table 1. Representative elasticity estimates for selected food items, Philippines

Data Base/Study	Sample Period	Model and Estimation Procedure	Commodity
1. National Accounts Data			
1.1 Lluch, Powell Williams (1977)	1953-65	Extended linear expenditure system	Food
1.2 Pante (1977)	1949-74	Linear expenditure system	Food
2. NCSO-FIES			
2.1 Goldman and Ranade	1971	grouped data	Cereals
2.2 Canlas (1986)	1965	Betancourt (1971) procedure on linear expenditure system, grouped data	Cereals
3. MA-SSD Surveys			
3.1 Ferrer-Guldager (1977)	1970-73 (4 rounds)	Double log, ungrouped data	Rice Corn & corn products
3.2 Kunkel et al. (1978)	1970-73	double log, ungrouped data	Rice Corn & corn products
3.3 San Juan (1976)	1974-76	Double-log single equation and Frisch method	Rice Corn Wheat products

Table 1. Representative elasticity estimates for selected food items. Philippines

Data Base/Study	Stratum	Price Elasticity	a/ Income Elasticity
1. National Accounts Data			
1.1 Lluch, Powell Williams (1977)	Philippines	-0.35	0.52 b/
1.2 Pante (1977)	Philippines	-0.71	0.99 b/
2. NCSO-FIES			
2.1 Goldman and Ranade	Rural		
	lower 40%	--	1.05
	Upper 10%	--	0.41
	Urban		
	lower 40%	--	0.26
	Upper 10%	--	0.37
2.2 Canlas (1986)	Philippines	-0.26	0.30
3. MA-SSD Surveys			
3.1 Ferrer-Guidager (1977)	Philippines	-0.53	-0.02
		-0.36	-0.24
3.2 Kunkel et al. (1978)	Urban c/	-0.63	-0.03
	Rural	-0.31	n.s.
	Urban	-1.37	-0.16
	Rural	-1.30	-0.26
3.3 San Juan (1976)		-0.40	0.30
		0.07	-0.91
		-1.65	0.61

Table 1. Representative elasticity estimates for selected food items, Philippines. (cont'd)

Data Base/Study	Sample Period	Model and Estimation Procedure	Commodity
3.4 Bouis (1982)	1973-76 (15 rounds)	Double log, ungrouped data	Rice Corn Wheat
3.5 Belarmino (1983)	1973-76	Double-log, seemingly unrelated regresions	Rice
3.6 Regalado	1973-76	Double-log, ungrouped data	Rice
4. Food & Nutrition Research Institute			
4.1 FNRI (1981)	1978	Double-log, ungrouped data	Rice
4.2 Quisumbing (1985)	1978	Double-log, ungrouped data, seemingly unrelated regression	ce & rice roducts

-- not computed
n.s. not significant
a/ Uncompensated price elasticity
b/ Total Expenditure elasticity
c/ Excluding Metro Manila
d/ Stratification by income quartile, with the lowest 25% as quartile I
e/ By per capita income class
f/ Food expenditure elasticity

Table 1. Representative elasticity estimates for selected food items, Philippines. (cont'd)

Data Base/Study	Stratum	Price Elasticity	a/ Income Elasticity
3.4 Bouis (1982)	weighted	-0.63	0.09
	average	-1.34	-0.27
		-0.78	0.41
3.5 Belarmino (1983)	I d/	-2.24	0.15
	II	-1.92	0.08
	III	-1.08	0.40
	IV	-1.59	0.12
3.6 Regalado	I d/	-2.48	0.25
	II	2.64	0.10
	III	-2.19	0.44
	IV	-1.91	0.07
4. Food & Nutrition Research Institute			
4.1 FNRI (1981)	< P500		0.12
	P500-P1500		0.15
	P1500 & above		-0.08
4.2 Quisumbing (1985)	I d/	-1.45	1.71 f
	II	-1.95	1.48
	III	-1.20	1.07
	IV	-1.0	0.55

achievement of this study was the construction of a more reliable series for personal consumption expenditure. Pante tested the empirical performance of single-equation estimation methods and three system methods, namely the LES, the Rotterdam demand system, and the indirect addilog system. The LES outperformed the other system models in predicting expenditures, but the Rotterdam model performed better than the other system and single equation methods on the basis of $(1 - R^2)$ and information accuracy criteria. However, Pante says that the single equation method has the advantages of flexibility in specification and simplicity in estimation and thus may be worth using in studies of single or a few commodities. The degree of commodity aggregation and the fact that aggregate time series data were used do not make these estimates useful for distribution-oriented analysis. Nevertheless, these estimates can provide a benchmark on the national level and is one of the first attempts to use system approaches in demand parameter estimation.

Grouped cross-section data are provided by the Family Income and Expenditure Surveys (FIES) conducted by the National Census and Statistics Office. A number of studies have used this data set, among which are those of Goldman and Ranade (1976), Arboleda (1982), and Canlas (1983). Although FIES data are available for 1965, 1971 and 1975, each study was able to make use of only one year in its estimation, thus posing a problem in estimating price elasticities in the absence of relative price variation through time. Goldman and Ranade did not estimate price elasticities, while Arboleda and Canlas used system methods incorporating restrictions on demand functions to do so, i.e. variants of the LES. Arboleda (1982) applied the extended linear expenditure system to 1975 FIES data for the analysis of expenditures and saving. Restrictions on demand parameters were used to compute residually for price elasticities for broad commodity groups. Unfortunately, the results were not realistic; some of the computed price elasticities were large and positive in contrast to earlier estimates. Part of this is due to the inappropriate application of a demand system with consumption and savings to a data set whose reliability is questionable. For example, income (and saving) statistics provided by the FIES remain suspect because of the observed dissaving in an implausibly large number of income groups. Errors in measurement will then be reflected in the results.

Canlas's (1983) study used an augmented Stone-Geary utility function with leisure explicitly considered. He used the Betancourt (1971) procedure to model the demand for leisure using wage rates as a proxy for the demand for leisure, and then used these results to estimate some LES parameters. In effect, variation of wage rates was treated as the source of price variation in the model. His results (in Table 1) appear plausible and are within the range of other elasticity estimates. This suggests that where data are scarce, the LES can provide a quick way of estimating demand parameters.

The studies using the FIES data used fairly aggregated commodity groups. Disaggregated commodity data are available from two other sources, the Ministry of Agriculture Special Studies Division (MA-SSD) Food Consumption Surveys and the Food and Nutrition Research Institute (FNRI) Nationwide Nutrition Surveys. The MA-SSD surveys are probably the most popular data source for food demand studies. The MA-SSD conducts quarterly nationwide food consumption surveys, with a sample of 1,000 hoouseholds in each survey, selected through a random sample stratified by region, subregion and jurisdictional unit (cities and municipalities). The basic data collected are quantities, expenditures, and prices of 167 food commodities consumed by the household members (Belarmino, 1983).

Most of the studies based on the MA-SSD data used single-equation, double-log demand functions (e.g. Ferrer-Guldager (1977), Kunkel et al. (1978), Snell (1980), Bouis (1982) and Regalado (1984)). Relatively few used the double-log method together with system methods, e.g. San Juan (1978) and Belarmino (1983), who estimated price and income elasticities using a double-log demand function and cross-price elasticities using the Frisch method. A number of studies also stratified the sample according to location (Kunkel et al., 1978; Bouis, 1982) and by income group (Snell, 1980; Belarmino, 1985; Regalado, 1984).

The FNRI Nationwide Nutrition Survey data have not been as well utilized for demand parameter estimation although they are extensively used for nutrition-related studies. Both sets of existing FNRI estimates (FNRI, 1981; 1984) do not include price elasticities but income and food budget (food expenditure) elasticities). Quisumbing (1985) constructed a price series from the FNRI data and used various approaches (double-log, S-branch system and the Frisch method) to estimate price elasticities. She found that the double-log equations with homogeneity restrictions estimated using seemingly unrelated regressions (Zellner, 1962) performed better than the more restrictive S-branch and Frisch methods. She did not estimate income elasticities since the income data were understated relative to the food expenditure data, and estimated food budget elasticities instead.

Although most of the studies mentioned above used household level data, no attempt was made to introduce demographic scaling; most simply expressed variables in per capita (instead of per equivalent adult) terms. Also, the treatment of nonconsuming households was not satisfactory; these were either dropped from the analysis or variables were transformed by adding a positive number to avoid indeterminacy in double-log regressions. As was pointed out earlier, a transformation which does not alter the shape of the distribution but simply shifts it upward does not remove the clustering of observations of the dependent variable. We compare the various estimates in the next section.

4.2 Comparison of Demand Elasticity Estimates.

A perusal of Table 1 reveals wide variation in the magnitude of the elasticity estimates, even when identical data sets are used. Methodology and grouping do have a significant effect on empirical results. For example, estimates of price elasticities from the FNRI data set are larger in absolute value than those from the MA-SSD. This is to be expected since the MA-SSD data, covering a longer time period, would exhibit greater price variation compared to a one-period, cross-section data set, and thus would yield smaller elasticity estimates. The FNRI estimates, however, are comparable in magnitude to those from Brazil (Gray, 1982), Indonesia (Timmer and Alderman, 1979), and Thailand (Trairatvorakul, 1982), which were based on cross-section data collected in a one-year period.[10]

Among the MA-SSD based estimates, there is also variation between income-group-specific and nonstratified sample estimates. Estimates of the own-price elasticity for rice from unstratified sample studies range from -0.40 (San Juan,

1978) to -0.53 (Ferrer-Guldager, 1977). Stratified sample studies (e.g. Kunkel et al., 1978, by rural/urban, and Bouis, 1982, by region and income group) range from -0.31 to -0.63. However, the absolute values of the own-price elasticities for rice estimated by Belarmino (1985) and Regalado (1984), whose studies use income as a stratification criterion, are quite large. Bouis has suggested that the large values may have been due to the pooling of Luzon, Visayas and Mindanao observations in estimation. Since these regions differ markedly in cereal consumption patterns, pooling them would increase quantity relative to price variation and thus would result in larger elasticity estimates. His own results were obtained by taking the consumption-share weighted average of elasticities computed separately for Luzon, Visayas and Mindanao.[11]

We also examine elasticity patterns from income-group-specific estimates. In the studies by Belarmino (1985), Regalado (1984), and Quisumbing (1985), the absolute values of the price elasticities decline as income increases. A "parabolic" pattern is observable for rice in the Regalado and Quisumbing studies, i.e., the own-price elasticity rises from the first to the second income stratum and then declines. The decline in the own-price elasticities is due to falling budget shares and income (or food budget) elasticities for staple foods as income increases. However, the nonlinearities indicate that the relationship between (uncompensated) price elasticities and income is not monotonic. Moreover, in Quisumbing's study, this behavior is more noticeable for energy foods such as rice, corn, other cereal products, and roots. The peak in the rice own-price elasticity in the second income stratum of both the Regalado and Quisumbing studies reflects the consumer's increased ability to purchase and substitute preferred energy foods for less preferred ones, e.g. rice for corn. Having satisfied his or her hunger or "bulk" constraint to some degree, the consumer can consider diversifying his or her diet (Bouis, 1982). The higher values of the elasticities may also be due to the existence of a wider range of affordable substitutes in the energy foods group once income reaches the second stratum level.

There seems to be limited scope for evaluating the benefits of system approaches vis-a-vis single equation methods, since there are relatively few system studies. Belarmino (1985) compared single-equation to seeming-unrelated-regression and Frisch methods and concluded that the single-equation approach yielded more plausible results. Quisumbing (1985) also found that the double-log functional form, estimated as a system performed better than S-branch and Frisch estimates. However, the above comparisons are faulty in that they compare two extremes: a "pragmatic" nonrestricted demand function and highly restrictive, additive demand systems. The drawback of using the pragmatic approach is the satisfaction of restrictions purely on an ad hoc basis; the defect of the restrictive systems, their lack of flexibility. There is a lot of scope for using flexible functional forms which can incorporate the restrictions of consumer theory in demand analysis, as well as refining the methodology for including variables other than prices and incomes in the estimating equations. The generation of reliable, disaggregated demand parameters is an important undertaking in the light of their role in consumption and nutrition policy analysis.

CHAPTER V

EMPIRICAL SPECIFICATION OF THE CONSUMER DEMAND SYSTEM

Data constraints, which will be discussed below, necessitated the estimation of two separate demand systems; (1) a food subsystem, estimated from the 1978 and 1982 FNRI Survey data; and (2) a translog expenditure system for five commodity groups, using grouped data from the Family Income and Expenditure Surveys conducted by the National Census and Statistics Office. We discuss the data sets and estimation procedures for the two systems in this section.

5.1 Food Subsystem

5.1.1 Data Set

The Food and Nutrition Research Institute conducted two nationwide surveys in 1978 and 1982, with sample sizes of 2,800 and 2,880 households, respectively, in all regions except Regions IX and XII of Mindanao. A three-stage stratified sampling design was used, with regional and urban/rural stratification and the provinces, barangays and households as sampling stages. In what follows, we will present data from the pooled sample; i.e., the average of the weighted data for 1978 and 1982.

The data from the Food Consumption Surveys, consisting of one-day food weighing conducted by trained nutritionists, contain information on the consumption and cost of 146 commodity groups, in the form of as-purchased, edible portion, and net intake weights, with their corresponding nutrient equivalents. The surveys also provide information on socio-economic factors, such as education and per capita income, fertility and health practices, type of livelihood and extent of home production.

Description of the Sample Households

On the average, food energy intake in 1978 amounted to 1,804 kilocalories (kcal) per capita per day, which was 88.6% adequate with reference to the recommended dietary allowance (RDA). Protein intake, at an average of 53.0 grams per capita per day, was 102.9% adequate (FNRI, 1981). In 1982, food energy intake was 1,808 kcal per capita per day, which was 89.0% adequate, while protein was 50.6 grams meeting 99.6% of the RDA. These averages, however, are misleading in the face of large disparities in the nutrient intake levels of various population groups. Nutrient intake levels are relatively high for higher income groups and households belonging to the occupational group of the professional, technical, entrepreneurial and skilled, while intake levels are alarmingly low for households headed by farm workers and small and hired fishermen.

Due to the desire to determine regional and occupational differences in consumption behavior, the sample was divided into three island groups (Luzon, Visayas and Mindanao) and five occupational categories (urban skilled, urban semi-skilled, urban unskilled, rural farm owners, and rural workers). Since we are using household-level data, these refer to households whose main income earners belong to the abovementioned categories.

Sample statistics for the pooled 1978 and 1982 data are presented in Table 2. Figures for 1982 were deflated to 1978 prices using the CPI for annual per capita income and the food component of the CPI for food peso value. Cursory examination of the annual per capita income figures and the food budget share will reveal that income has been severely understated in this survey. This is a common phenomenon in income and expenditure surveys conducted in the Philippines.[2] Because the FNRI surveys were designed to measure food expenditures quite accurately, however, we will rely on the food budget measurement and subsequently employ alternative methods using the NCSO data set to obtain estimates for the nonfood commodities.

Households in the urban areas had higher energy and protein intakes and nutrient adequacies than those in the rural areas, reflecting rural-urban income disparities. Farm workers and small and hired fishermen had the lowest intakes and adequacies, while the professional, technical, entrepr eurial and skilled had the highest. Despite this, on the average, the urban groups had 90.5% food energy adequacy and the rural groups attained only 87.9% adequacy.

Table 2. Summary of sample statistics by urbanization and occupational group, Philippines 1978 and 1982, pooled.

PARTICULARS	URBAN				RURAL		
	All	Professional Technical, Enterprenueral 1	Semi-skilled 2	Unskilled No Occupation 3	All	Farm Owners 4	Farm Workers, Small and Hired Fishermen 5
Deflated Annual per capita-income (P)*							
Mean	1789	2654	1566	1570	848	1145.64	654
Median	1183	1924	1050	986	525	603.64	423
Range: Minimum	0	92	17	0	4	25	4
Maximum	63815	63815	34509	22116	93239	93239	13846
Energy							
Mean one-day per capita (kcal)	1852	1931	1816	1864	1783	1879.68	1737
Percent adequacy	90.5	94.3	88.9	90.9	87.9	91.46	85.8
Protein							
Mean one-day per capita (g)	51.9	56.1	50.4	51.5	48.1	50.73	46.5
Percent adequacy	100	108.5	97.9	97.4	94.7	97.94	91.6
Deflated Mean one-day per capita food expenditure (P)R	3.5	4.22	3.26	3.4	2.18	2.35	1.95
Percent of income spent on food	71.4	58.0	75.9	78.9	93.7	76.86	108.8

* Deflated to 1978 level using the CPI for annual per capita income and the food component of the CPI for food expenditure.
1 Includes also large farm owners, managers, fishermen.
2 Includes also small farm owners.
3 Includes also farm workers, small and hired fishermen.
4 Includes also professional, technical, entrepreneurial, skilled and semi-skilled.
5 Includes also unskilled and no occupation.

With respect to protein, the urban groups, on the average, attained 100% adequacy; the rural groups, 94.7%. Calorie underconsumption appears to be the critical reason for nutrient inadequacy; it is often argued (Florencio, 1982) that at the level of vulnerable groups, calorie adequacy should override all other nutritional considerations. It is surprising that the households of unskilled workers and those with no occupation have higher adequacies than those of semi-skilled workers, but this is due largely to receipts of remittances, as we shall see in Table 3.

Table 3 presents the distribution of income sources for each occupational group. Urban households received 23.5% of their income from salaries, 20.0% from other agribusiness activities (e.g. processing and marketing of agrricultural products), 18.9% from gifts, and 13.3% from wages. Major income sources for rural households, on the other hand, were agricultural crops and livestock (31.9%), other agribusiness activities (21.7%), and gifts (16.0%). Among urban households, the professional and skilled obtained 41.3% of their income from salaries and 8.0% from wages, 15.7% from other agribusiness, and 14.0% for gifts. Semi-skilled workers received about equal proportions of income from salaries and wages (18.4% and 18.6%, respectively), 26.1% for other agribusiness, and 15.2% as gifts. Gifts and pensions accounted for the bulk of the income of

Table 3. Percentage distribution of income by source by occupational group by urbanization, Philippines 1978 and 1982, pooled.

SOURCE OF INCOME	URBAN				RURAL		
	All	Professional Technical, Enterpre-neural	Semi skilled	Unskilled No Occupation	All	Farm Owners	Farm Workers, Small and Hired Fishermen
Salaries	23.5	41.3	18.4	9.8	5.5	9.4	1.2
Wages	13.3	8.0	18.6	7.3	9.4	7.3	8.2
Agricultural crops and livestock	11.9	12.3	12.2	10.5	31.9	35.9	32.5
Fishing	2.4	1.3	3.3	1.6	8.3	3.8	15.5
Other agribusiness	20.0	15.7	26.1	10.2	21.7	21.7	13.8
Rent	4.0	5.0	3.9	2.5	0.5	0.4	0.4
Pensions	4.6	1.4	0.9	19.4	5.3	1.8	10.9
Gifts	18.9	14.0	15.2	36.7	16.0	18.7	16.0
Others	1.5	1.0	1.6	2.0	1.2	0.9	1.6
TOTAL	100.1	100.0	100.2	100.0	99.8	99.9	100.1

Note: Percentages may not sum to 100.0 due to rounding.

unskilled workers and those without a reported occupation, with 36.7% coming from gifts and 19.4% coming from pensions. Turning now to farm owners, the major source of income is from agricultural crops and livestock, accounting for 36.0%, followed by other agribusiness activities, 21.5% and gifts, 18.8%. Farm workers and small and hired fishermen earn the bulk of their income from agricultural crops and livestock (32.5%), with gifts amounting for 16.0%; fishing, 15.5% and other agribusiness, 13.8%.

Table 4 shows the distribution of farm owners, managers and farm workers by farm size. Most of the farm owners and managers (31.8%) owned or operated farms between 1.0-1.9 hectares in size, with about 64.1% of all farmers operating farms below two hectares. Only 6.3% of the households in the sample farmed land above 5 hectares in size. Most of the farm workers also worked on small landholdings, with 74.1% of farm workers in this sample working in farms smaller than two hectares. Thus, the sample clearly shows the smallholder nature of Philippine agriculture.

Indicators of ownership and tenancy patterns in the rural areas are presented in Table 5. Most of the farm owners are owner-operators (85.3%), with 6.2% as share tenants, 1.4% as kaingeros and 7.0% inn other categories. On the other hand, 66.8% of the farm laborers are share tenants, 9.5% are farm laborers, 5.9% are kaingeros, 9.7% are owner-operators, and 8.0% fall into the remaining category of lease tenants, owners, and

Table 4. Distribution of farm owners/managers and farm workers by farm size by urbanization, Philippines 1978 and 1982, pooled.[a]

Farm Size (ha)	RURAL			
	Farm Owners and Managers		Farm Workers	
	Number	%	Number	%
Less than 0.5	54	14.2	143	26.4
0.5 - 0.9	69	18.1	105	19.4
1.0 - 1.9	121	31.8	153	28.3
2.0 - 2.9	63	16.5	86	15.9
3.0 - 4.9	36	9.4	32	5.9
5.0	14	3.7	7	1.3
More than 5	24	6.3	15	2.8
TOTAL	381	100.0 (41.3)	541	100.0 (58.7)

[a]Number in parenthesis indicates percentage of all rural households.

Table 5. Frequency and percentage of farm owners/managers and farm worker by tenure status by urbanization, Philippines 1978 and 1982, pooled.a/

TENURE	RURAL					
	ALL		Farm Owners		Farm Workers	
	Number	%	Number	%	Number	%
Farm Laborer	45.00	5.30	–	–	45.00	9.50
Share Tenant	399.00	40.30	23.00	6.20	316.00	66.80
Kaingero	33.00	3.90	5.00	1.40	28.00	5.90
Owner–Operator	361.00	42.90	315.00	85.40	46.00	9.70
Others (lease tenant, amortizing owner,	64.00	7.60	26.00	7.00	38.00	8.00
TOTAL	842.00	100.00	369.00	100.00	473.00	99.90
				(43.80)		(56.20)

others.

5.1.2 Consumption and Nutrition Patterns

This section describes the dietary patterns revealed in the 1978 and 1982 surveys as a background to the interpretation of the elasticity estimates. We pay special attention to consumption differences across occupational groups, the percentage contribution of various commodities to total calorie and protein intake across income groups, and prices per nutrient unit of various commodities.

Cereals are important in the Philippine diet as sources of calories and protein. In 1978, 69.7% of mean one-day per capita calorie intake and 53.1% of average daily per capita protein intake were provided by cereals alone--rice, corn, and other cereal products. In 1982, the relative importance of the cereals group did not change substantially, with cereals contributing 69.8% and 54.8% to total calorie and protein intake, respectively (FNRI, 1981, 1984). In our pooled sample, rice is the main source of food energy for both rural and urban households (Table 6). Rice alone accounts for 48.7% of food energy intake in the urban areas and 60.5% correspondingly, in the rural areas. Other important food energy sources for the urban dweller are other cereal products (mostly wheat-based) at 8.1%, fats and oils at 8.0%, and dairy products at 5.7%. In the rural areas, the second most important food energy source is corn (8.7%), followed by

Table 6. Percentage contribution of food commodities to energy intake by occupational group by urbanization, Philippines 1978 and 1982 pooled.

COMMODITY	URBAN				RURAL		
	All	Professional Technical, Enterpre-neural,	Semi skilled	Unskilled No Occupation	All	Farm Owners	Farm Workers, Small and Hired Fishermen
Rice	48.7	42.7	50.2	50.6	60.5	59.6	62.8
Corn	2.3	1.2	2.8	2.4	8.7	8.2	9.6
Rice and corn products	1.2	1.2	1.1	1.4	0.8	1.0	0.7
Other cereal products	8.1	9.0	7.8	7.8	3.1	3.1	2.7
Starchy roots and tubers	1.1	0.9	1.1	1.2	2.7	3.2	2.8
Sugars and syrup	5.2	5.7	5.2	5.0	3.6	3.7	3.3
Fats and oils	8.0	9.3	7.5	8.0	4.7	4.6	4.3
Fish	3.9	3.7	4.0	4.0	3.6	3.6	3.5
Meat	7.5	9.8	6.7	7.3	2.6	3.0	1.8
Poultry	0.8	1.1	0.6	0.6	0.5	0.5	0.5
Eggs	1.1	1.5	1.0	1.0	0.5	0.5	0.3
Milk and milk products	5.7	6.5	5.9	4.7	2.6	2.8	1.7
Dried beans, nuts and seeds	1.2	1.4	1.1	1.1	1.3	1.4	1.2
Vegetables	1.9	1.7	1.8	1.8	2.0	2.0	2.0
Fruits	2.4	3.0	2.3	2.3	2.1	2.1	2.1
Miscellaneous	1.1	1.2	1.0	1.0	0.8	0.8	0.7
TOTAL	100.1	99.9	100.1	100.2	100.1	100.1	100.2

fats and oils (4.7%), sugars and syrups and fish, both with 3.6% of the total.

Rice is also the main protein source for both urban and rural households, though it is significantly more important in rural diets (Table 7). In the urban areas, rice accounts for 35.1% of protein intake, followed by 23.6% from fish and 11.6% from meat. Rice contributes a high 45.9% to total protein intake of rural households, followed by fish, 22.6% and meat, 5.0%. In general, urban households have more diversified nutrient sources.

Consumption differences also exist across occupational groups, a result of both income and occupational differences. As discussed in a previous study of the 1978 data set (Quisumbing, 1985), there is a tendency towards more expensive nutrient sources as income increases, indicated by changes in the contribution of specific commodities to total nutrient intake, the average consumption of each commodity by each income group, the food budget weights, average prices, and the distribution of the total amount consumed by income group. This is also evident when occupational groupings are used, as in the present study. Based on the income ranges and average per capita income and food expenditures, we can make a rough ranking of the occupational groups according to income--the poorest are the farm workers, followed by the farm owners and managers (most of whom are smallholders), the urban unskilled, the semi-skilled, and

Table 7. Percentage contribution of food commodities to protein intake by occupational group by urbanization, Philippines, 1978 and 1982.

COMMODITY	URBAN				RURAL		
	All	Professional Technical, Enterpre-neural,	Semi skilled	Unskilled No Occupation	All	Farm Owners	Farm Workers, Small and Hired Fishermen
Rice	35.1	29.6	36.6	37.0	45.9	45.2	48.1
Corn	1.9	1.0	2.4	2.0	7.6	7.2	8.5
Rice and corn products	0.6	0.5	0.6	0.6	0.5	0.5	0.2
Other cereal products	8.4	9.0	8.1	8.1	3.1	3.1	2.7
Starchy roots and tubers	0.4	0.5	0.4	0.4	0.9	1.1	0.9
Sugars and syrup	0.2	0.2	0.1	0.1	n	0.1	n
Fats and oils	0.8	1.1	0.7	0.9	0.9	1.0	1.0
Fish	23.6	21.8	24.3	24.5	22.6	22.4	22.5
Meat	11.6	15.4	10.3	10.6	5.0	5.4	3.8
Poultry	3.3	5.1	2.9	2.4	1.7	1.9	1.5
Eggs	2.9	3.8	2.7	2.6	1.4	1.4	1.0
Milk and milk products	3.5	4.1	3.5	3.1	1.7	1.8	1.1
Dried beans, nuts and seeds	2.7	2.9	2.7	2.6	3.2	3.3	3.0
Vegetables	3.4	3.1	3.2	3.5	4.0	3.9	4.3
Fruits	1.0	1.1	0.9	0.8	0.9	0.9	1.0
Miscellaneous	0.8	0.7	0.8	0.8	0.6	0.5	0.5
TOTAL	100.2	99.9	100.2	100.0	100.0	99.8	100.1

finally, the urban professional and skilled, who have the highest incomes. The changes in consumption patterns are thus affected by income, occupation, and location.

Going back to Table 6, we note that the percentage contribution of various commodities to total calorie intake varies by occupational group. Among farm workers, rice accounts for 62.8% of calorie intake, followed by corn (9.6%) and fats and oils (4.3%). The share of rice drops to 59.6% for farm owners, the share of corn also going down to 8.2%, and that of fats and oils increasing slightly to 4.6%. Rice and corn's contribution to calorie intake decreases as we view the range from the urban unskilled to the urban skilled. Food energy sources which become more significant are meat, other cereal products, sugars, and milk products. In the urban skilled households, for example, meat accounts for 9.8% of calorie intake, followed by fats and oils (9.3%), other cereal products (9.0%) and milk products (6.5%). Despite the diversification towards other food energy sources, rice continues to be the most important calorie source. However, its share declines due to dietary diversification and substitution towards more expensive calorie sources.

Table 7 presents similar data for protein intake. The major protein sources for all occupational groups are rice and fish, although the shares decline for higher-earning occupational groups. Rice contributes 48.1% of total protein are smallholders), the urban unskilled, the semi-skilled, and finally, the urban professional and skilled, who have the highest incomes. The changes in consumption patterns are thus affected by income, occupation, and location.

Going back to Table 6, we note that the percentage contribution of various commodities to total calorie intake varies by occupational group. Among farm workers, rice accounts for 62.8% of calorie intake, followed by corn (19.1%) and sugars (4.3%). The share of rice drops to 59.6% for farm owners, the share of corn also going down to 8.2%, and that of sugars increasing slightly to 4.6%. Rice and corn's contribution to calorie intake decreases as we view the range from the urban unskilled to the urban skilled. Food energy sources which become more significant are meat, other cereal products, fats and oils, and milk products. In the urban skilled households, for example, meat accounts for 9.8% of calorie intake, followed by fats and oils (9.3%), other cereal products (9.0% and milk products (6.5%). Despite the diversification towards other food energy sources, rice continues to be the most important calorie source. However, its share declines due to dietary diversification and substitution towards more expensive calorie sources.

Table 7 presents similar data for protein intake. The major protein sources for all occupational groups are rice and fish, although the shares decline for higher-earning intake of farm workers followed by fish, 22.5% and corn, 8.5%. Among farm-owning households, rice accounts for 45.2%, fish, 22.5%, corn 7.2%, and meat, 5.4%. Corn is no longer an important protein source for urban households, although rice continues to be the dominant source. The share of rice decreases from 37.0% to 29.6% across the urban skill categories, the share of fish also decreases from 24.5% to 21.8%, while that of meat increases from 10.6% to 15.4%.

An examination of per capita consumption of various foods reveals consumption difference across occupational groups (Table 8). Per capita consumption increases from 319 grams/day (g/day) by farm workers, to 330 g/day by farm owners, then decreases to 278 g/day for urban unsksilled households. Urban skilled households consume the least rice, at 239 g/day per capita. An even more marked decrease in per capita consumption of corn and starchy roots is noticeable, while per capita consumption of other cereal products (mostly wheat-based) rises steadily from lower to higher earning occupational groups. Per capita consumption of all other commodities increases across the occupational spectrum, except in the case of fish consumption, which is higher for farm owners than for farm workers, further increasing for urban unskilled workers, then decreasing slightly for the urban skilled and semi-skilled. This reflects dietary diversification towards more expensive protein sources like meat,

Table 8. Mean one-day per capita consumption (g) of commodities by occupational group by urbanization, Philippines 1978 and 1982, pooled.

COMMODITY	URBAN All	URBAN Professional Technical, Enterpre-neural,	URBAN Semi skilled	URBAN Unskilled No Occupation	RURAL All	RURAL Farm Owners	RURAL Farm Workers, Small and Hired Fishermen
Rice	262	239	265	278	317	330	319
Corn	15	8	17	15	47	47	51
Rice and corn products	10	11	9	12	7	9	5
Other cereal products	35	42	34	34	12	13	10
Starchy roots and tubers	20	20	19	22	50	64	48
Sugars and syrup	36	43	34	34	20	22	18
Fats and oils	27	33	25	26	12	12	11
Fish	114	115	113	122	104	106	102
Meat	48	67	41	47	18	20	13
Poultry	13	21	11	11	7	8	6
Eggs	14	21	13	13	6	7	4
Milk and milk products	60	87	55	48	28	30	17
Dried beans, nuts and seeds	10	13	9	10	9	10	7
Vegetables	129	131	127	134	142	150	138
Fruits	127	156	119	120	92	95	84
Miscellaneous	28	33	27	27	25	28	25
TOTAL	948	1040	918	953	896	951	858

poultry and dairy products.

These food commodities also vary in terms of their relative importance in the food budget (Table 9). Among rural households, rice accounts for the largest share of the food budget, at 27.7%, followed by fish, 20.7%. In the urban areas, on the other hand, expenditure on protein-rich foods (fish and meat) comprises a larger share of the food budget than rice. More specifically, fish accounted for 18.1% of the food budget, meat, 13.1%, and rice, 15.7%.

Table 10 presents the average price per kilogram paid by consumers for various foods and their approximate price per 1,000 nutrient units. In 1978, corn (milled corn, without corn products) was the cheapest among the energy foods, at P1.66/kg., followed by starchy roots and tubers, at P1.87/kg. and rice, at P2.11/kg. In 1982, corn was still the cheapest at P2.86/kg., but rice became cheaper (P3.15/kg.) than starchy roots and tubers (P3.96/kg). Fats and oils, rice and corn products, and other cereal products were the more expensive energy foods. Cost per nutrient unit, however, depends not only on the cost of the food item, but also on its nutrient content. Corn, rice, and fats emerge as the cheapest sources of energy per nutrient unit at P0.46/1,000 kilocalories, and P0.61/1,000 kilocalories, and P0.93/1,000 kilocalories, respectively, in 1978 prices. In 1982, the same rankings were maintained, although absolute prices

Table 9. Percentage of food peso value among commodities by occupational group by urbanization, Philippines 1978 and 1972, pooled.

COMMODITY	URBAN				RURAL		
	All	Professional Technical, Enterpre-neural,	Semi skilled	Unskilled No Occupation	All	Farm Owners	Farm Workers, Small and Hired Fishermen
Rice	15.7	12.0	16.9	16.8	27.7	26.7	30.5
Corn	0.7	0.4	0.8	0.7	3.4	2.8	3.9
Rice and corn products	1.2	1.0	1.3	1.5	0.9	1.2	0.8
Other cereal products	6.6	5.9	6.6	5.9	3.5	3.6	3.3
Starchy roots and tubers	0.9	1.0	0.9	0.9	1.6	[illegible]	1.8
Sugars and syrups	3.9	3.9	3.9	4.6	3.2	3.5	3.0
Fats & Oils	3.7	4.0	3.1	4.6	2.7	2.8	2.8
Fish	18.1	16.5	18.5	19.5	20.7	20.2	22.0
Meat	13.1	15.6	12.1	12.6	6.9	7.3	5.3
Poultry	3.8	4.8	3.4	2.6	2.3	2.9	2.2
Eggs	3.6	4.4	3.4	3.4	2.7	2.6	2.0
Milk and milk products	9.3	10.2	9.6	7.8	5.0	5.7	3.1
Dried beans, nuts & seeds	1.6	1.6	1.5	1.5	1.8	1.7	1.8
Vegetables	7.3	6.9	7.7	7.15	9.0	9.1	9.3
Fruits	5.3	6.0	5.0	5.0	4.2	4.1	3.9
Miscellaneous	5.2	5.0	5.2	5.0	4.4	4.1	4.3
TOTAL	100.0	100.2	99.9	99.9	100.1	100.0	100.0

Table 10. Average Price Per Kilogram and Price Per Nutrient Unit[1], 1978 and 1982.

COMMODITY	Price / Kg. 1978	Price / Kg. 1982	Energy Price/100 Kcal 1978	Energy Price/100 Kcal 1982	Protein Price/100 grams 1978	Protein Price/100 grams 1982
	Price/100 grams					
Rice	2.11	3.15	0.61	0.92	2.80	4.31
Corn	1.66	2.86	0.46	0.76	2.10	3.24
Rice and corn products	6.61	10.20	3.78	3.97	17.63	23.80
Other cereal products	6.18	15.60	1.85	2.84	7.21	10.03
Starchy roots and tubers	1.87	3.96	1.73	3.96	17.30	33.26
Sugars and syrups	2.83	7.81	1.14	2.12	144.17	339.56
Fats & Oils	6.29	8.23	0.93	1.03	40.88	28.80
Fish	5.76	10.06	8.51	17.49	5.34	10.06
Meat	12.48	16.61	5.16	6.60	13.02	15.60
Poultry	12.12	16.21	9.43	14.74	12.12	14.74
Eggs	9.98	14.49	7.26	10.03	9.98	13.04
Milk and milk products	7.96	27.92	10.10	45.50	26.27	111.68
Dried beans, nuts & seed	5.27	9.92	2.11	4.31	3.83	6.61
Vegetables	2.16	4.14	8.24	16.31	15.66	28.33
Fruits	2.02	3.36	5.12	8.57	42.02	85.68
Miscellaneous	10.35	17.74	16.72	31.54	72.45	189.23

[1] Price/1000 nutrient units = $\frac{\text{Price/Kg}}{\text{Nutrient Unit/g}}$

increased over the five-year interval.

Among the protein sources, the cheapest source per nutrient unit in 1978 was corn (P2.10/100 grams protein), followed by rice (P2.80/100 grams protein), dried beans (P3.83/100 grams protein) and fish (P5.34)/100 grams protein). In 1982, corn, rice and dried beans were the cheapest, but the cost per unit of protein from fish rose relative to that from starchy roots and tubers.

Integrating the results from the above tables, we note the following: 1) the differences in consumption patterns across income groups, with higher income groups consuming higher quantities per capita of most foods; and 2) the predominance of the consumption of cheaper calorie and protein sources by the lower income groups. This suggests that price subsidies aimed at foods such as meat, poultry, eggs, milk, sugar and other cereal products may not have a great nutritional impact on deficient groups since these foods are mostly consumed by the higher income groups which are already nutritionally sufficient. Even if some commodities may be cheap in terms of price per nutrient unit, nonselective price subsidies may not be cost effective since one will be subsidizing the consumption of well-nourished groups.

5.1.3 Regional Consumption Differences

Aside from rural-urban consumption differences, significant regional variation in consumption also exists. This is to be expected in an archipelagic country with varied patterns of cultivation and land use. Bennagen (1982) relates per capita consumption of staples to percent of area planted with staples in the Philippines. She points out that rice consumption is low in Visayas and Mindanao, where a smaller area is planted to rice, than in Luzon. On the other hand, corn consumption is highest in major corn-growing regions, such as Cagayan Valley, Central Visayas, and the Mindanao regions. The same is true for sweet potatoes and cassava, where both consumption of the crop and the area planted to it are highest in Bicol, Central and Eastern Visayas, and in regions of Mindanao. Bennagen concludes that where rice consumption is high, consumption of the less preferred staples is insignificant, as in Luzon. Where rice consumption is low, consumption of corn and root crops is high, a pattern observed in Visayas and Mindanao.

These patterns are easily observable from the 1978 and 1982 FNRI data (Table 11). Per capita consumption of staples and other commodities varies across the three island groups, Luzon, Visayas and Mindanao. Per capita consumption of rice is highest in Luzon, while corn consumption is significant in Visayas and Mindanao. As a whole, per capita consumption of

Table 11. Mean one-day per capita consumption (g) of commodities by island group, Philippines 1978 and 1982, pooled.

COMMODITY	PHILIPPINES	LUZON	VISAYAS	MINDANAO
Rice	299	314	264	299
Corn	36	6	89	68
Rice and corn products	8	8	8	8
Other cereal products	20	26	12	10
Starchy roots and tubers	40	36	34	67
Sugars and syrups	21	24	16	15
Fats & Oils	14	18	8	10
Fish	108	102	122	108
Meat	28	35	16	24
Poultry	9	11	7	6
Eggs	9	11	6	6
Milk and milk products	43	55	27	25
Dried beans, nuts & seed	9	10	8	6
Vegetables	138	157	108	117
Fruits	103	107	103	87
Miscellaneous	27	20	37	34

other cereal products, sugars, fats, meat and milk are higher in Luzon than in the other two regions.

Regional consumption differences are among the reasons for the varying percentages of households reporting zero consumption of various commodities (Table 12). Regional taste differences, seasonality, or regional differences in availability, among others, may be reasons for nonconsumption of certain commodities. Another, of course, is that lower-income households will not be able to afford consumption of some commodities at prevailing prices. Some of the consumers in the sample, therefore, may be marginal consumers whose consumption cannot be predicted with certainty. This is the rationale behind the use of a limited dependent variable model in the analysis.

Aside from consumption differences, there are also regional food price differences, as presented in Table 13. We can infer that the price differences may be a reason that some regions have lower consumption; a corn-growing region like Mindanao, for example, would have lower prices, which could make the commodity more affordable to marginal consumers. Due to these regional consumption differences, we have decided to estimate separate sets of equations for Luzon, Visayas and Mindanao, and then compute an aggregated elasticity matrix instead of estimating a single set of demand functions for the entire sample.

Table 12. Frequency and percentages of households reporting zero consumption by island group, Philippines 1978 and 1982 pooled.

COMMODITY	Philippines		Luzon		Visayas		Mindanao	
	No. of House-holds	Percent	No. of House-holds	Percent	No. of House-holds	Percent	No. of House-holds	Percent
Rice	420	7.4	13	0.4	314	20.4	93	12.7
Corn	4861	85.6	3258	95.7	1042	67.6	561	76.6
Rice and corn products	4676	82.3	2720	79.9	1319	85.5	637	87.0
Other cereal products	2627	46.3	1228	36.1	926	60.1	473	64.6
Starchy roots and tubers	4162	73.3	2397	70.4	1233	80.0	532	72.7
Sugars and syrups	1326	23.3	448	13.2	596	38.7	282	38.5
Fats & Oils	1085	19.1	382	11.2	524	34.0	179	24.5
Fish	272	4.8	161	4.7	74	4.8	37	5.1
Meat	3717	65.4	1977	58.0	1213	78.7	527	72.0
Poultry	5082	89.5	2981	87.5	1422	92.2	679	92.8
Eggs	3732	65.7	2021	59.3	1173	76.1	538	73.5
Milk and milk products	3087	54.3	1551	45.5	1046	67.8	490	66.9
Dried beans, nuts & seed	3513	61.8	2012	59.1	1043	67.6	458	62.6
Vegetables	345	6.1	120	3.5	147	9.5	78	10.7
Fruits	2479	43.6	1312	38.5	799	51.8	368	50.3
Miscellaneous	38	0.7	18	0.5	19	1.2	1	0.1

Table 13. Average prices paid for food commodities, by island group, pooled 1978 and 1982 data.

COMMODITY	LUZON	VISAYAS	MINDANAO
	Price per kilogram (₱/kg.)		
Rice	2.62	2.66	2.83
Corn	2.79	2.31	2.05
Rice and corn products	8.96	7.13	7.97
Other cereal products	11.27	10.65	12.63
Starchy roots and tubers	3.10	2.66	3.13
Sugars and syrups	5.38	5.26	5.24
Fats & Oils	7.28	7.14	7.52
Fish	8.38	6.66	8.21
Meat	14.52	13.95	13.96
Poultry	13.78	14.21	13.53
Eggs	12.50	11.78	12.74
Milk and milk products	17.57	18.40	19.36
Dried beans, nuts & seed	7.49	7.32	8.36
Vegetables	3.03	3.28	3.80
Fruits	3.08	2.07	1.71
Miscellaneous	16.92	9.04	8.58

The final grouping by island group and occupational category is presented in Table 14. As mentioned earlier, we have opted to have a strict delineation by rural-urban categories in oder to emphasize the locational differences.

5.1.4 Functional Form and Variable Specification

Due to the need to consider the probability of nonconsumption of certain food commodities, the tobit estimation method for the treatment of limited dependent variables will be used. The tobit estimation procedure involves maximization of the nonlinear tobit likelihood function. For ease of consumption, we use a function which is linear in the parameters to be estimated. However, although the previously discussed demand systems are linear in parameters, the lack of a computationally tractable multivariate tobit estimator means that the adding up and symmetry restrictions derived from demand theory cannot be readily imposed; thus, we estimate the demand equations in single-equation form. We use a systems method for the second set of data, discussed in Section 4.2.

We follow a methodology similar to Pitt (1984) and estimate the following single-equation functional form for each of the food commodities, stratified by island group:

$$(5.1)\quad q_i = \alpha_i + \beta_i \ln m_f + \gamma_{ij} \ln p_j + \sum_t \theta_{ik} OCC_k + \sum_t \sigma_t \, Year_t + u_i$$

Table 14. Frequency and percentage of households, by occupational group, island and urbanization, Philippines 1978 and 1962, pooled.

ISLAND GROUP	Number of Household	URBAN						RURAL			
		Professional and skilled		Semi-skilled 2		Unskilled No		Farm Owners 4		Farm Workers 5	
		No.	%	No.	%	No	%	No.	%	No.	%
Philippines	5680	469	8.3	933	16.4	465	8.2	1919	33.8	1894	33.3
Luzon	3406	316	9.3	707	20.8	328	9.6	1014	29.8	1041	30.6
Visayas	1542	98	6.4	166	10.8	95	6.2	563	36.5	620	40.2
Mindanao	732	56	7.7	60	8.2	41	5.6	343	46.9	232	31.7

1 Including urban large farm owners and managers.
2 Including rural small farm owners and managers
3 Including farm workers and small and hired fishermen
4 Including rural skilled and semi-skilled
5 Including rural unskilled

where q_i is physical consumption of the i^{th} good, per adult equivalent unit (AEU), per month

m_f is real food expenditure per month per adult equivalent unit[12]

p_j is the price of the j^{th} good

OCC_k is the K^{th} occupational dummy variable

$Year_t$ = 1 if the survey period is 1982, 0 for 1978

and U_t is the random error term

Quantities are those of the sixteen commodities described in the previous section namely rice, corn rice and corn products other cereal products starchy roots and tubers, sugars and syrups fats and oils fish, meat, poultry eggs, milk and milk products dried beans nuts and seeds vegetables, fruits and miscellaneous products, all expressed in grams per number of adult equivalent units (AEUs) in each household[13]

Prices for consuming households were computed by dividing the expenditure on the item by the quantity consumed Prices for nonconsuming households were imputed using the average price in each region depending on whether the household was rural or urban (e g , Western Visayas, rural or Western Visayas urban) Adequate price variation exists due to both regional price differences and differences across the five year survey interval

Nominal food expenditure was transformed into real expenditure using a suitable price index Stone s (1953) price index $\tilde{P} = \prod_{i=1}^{n} P_i^{w_i}$ where the w_i are expenditure shares can be used as general index of prices (Pitt, 1983, Deaton and Muellbauer 1980) Homogeneity of degree zero in prices is readily tested by restricting $\sum \gamma_{ij} = 0$

Four occupational dummy variables are used URB1 = 1 if the main income earner is an urban professional technical or skilled worker or an urban large farm owner, zero otherwise, URB2 = 1 if the main income earner is an urban semi-skilled worker or an urban small farm owner RUR1 = 1 if the main income earner is a rural farm owner or large fisherman and RUR2 = 1 if the main income earner is a rural farm laborer or small fisherman If the household does not fall into any of the above categories, i e , the household s main income earner is an urban unskilled worker or has no occupation, then all the dummies equal zero This last category is the residual category

Each set of equations was estimated separately for each island group and price elasticities computed separately

5 2 Complete Expenditure System

The implicit assumption involved in estimating a separate food subsystem is that the utility function is separable into food and nonfood components The estimation of the parameters in the previous section was based on that assumption; another practical consideration is the fact that income is severely understated in the FNRI surveys. Moreover, the 1978 and 1982 FNRI survey do not have data on nonfood expenditures. In order to estimate a complete expenditure system we used data from the Family Income and Expenditure Survey (FIES) from the National Census and Statistics Office (NCSO).

5.2.1 The Family Income and Expenditure Surveys

The Family Income and Expenditure Surveys (FIES) were conducted by the National Census and Statistics Office (NCSO), formerly known as the Bureau of Census and Statistics (BCS) in 1957, 1961, 1971, and 1975. The 1975 FIES consisted of two surveys: (1) the 1975 Integrated Census of the Population and its Economic Activities, Phase II (IC-PEA II); and (2) 1975 Family Expenditure Survey (FES).

The FIES are the most commonly used source of nationwide income and expenditure data, being the most comprehensive, with a reasonable sample size and sampling design, and having been conducted fairly regularly. However, because of a number of weaknesses, which we shall point out below, the quality of the data, especially the income data, is subject to question. It is important to note these weaknesses and to account for them in the choice of a functional form for estimation purposes.[14]

Limitations of the FIES Data

The FIES use interview and recall methods to collect data. The data are therefore subject to recall lapse due to the difference between the period covered in the survey (the reference period) and the time of reporting. Due to recall lapse, income and expenditure tend to be underestimated, though income is subject to a more severe underestimation bias. The problem is further compounded if the questionnaire is not sufficiently comprehensive or is not followed up by supplementary questions.

Methodological differences also make comparability across surveys difficult. The two main reasons for lack of comparability are: (1) different time lags, and, consequently, varying degrees of recall lapses and underestimation of income and expenditures; and (2) changes in definitions, information, and area grouping over time. With regard the first reason, the reference period for the 1961 FIES was calendar year 1961, although the survey was conducted in April 1962. The 1965 FIES was conducted in May 1966, with calendar year 1965 as reference period. The 1971 FIES, conducted in May 1971, covered the twelve months from May 1, 1970 to April 30, 1971. Finally, the income part of the 1975 FIES was conducted in December 1975 and the expenditure part in March 1976. The recall lapse and resultant underestimation would, therefore, vary from survey to survey.

Apart from the addition of socio-economic variables in subsequent FIES (as well as the dropping of the industrial affiliation variable in the 1975 FIES), some definitions and area groupings have changed over time. The definition of urban areas changed in the various FIES, with the major changes being inclusion of peripheral urbanized areas around urban center starting in the 1971 FIES. The regional groupings of the provinces have also changed. Since this study does not use the urban-rural grouping but the regional cell incomes, and since price deflators are not available for the new 13-region grouping, some provinces and regions had to be reclassified and combined to be consistent with the 10-region classification of the 1961, 1965, and 1971 FIES.

The most serious drawback of the FIES data is the understatement of income data relative to the expenditure data, as shown by the discrepancy between personal income estimates from the FIES, (Table 15) and those from the National Income Accounts, as well as the implausibly negative aggregate savings rates (Table 16).

Table 15 shows that from 1961 to 1971, FIES data are lower than national family income estimates by a constant margin of about 30%; the discrepancy increased to 47% in 1975. Personal

Table 15. Comparison of National Acounts and FIES Estimates of Family Income and Expenditure, 1957-75

	1957	1961	1965	1971	1975
NA personal income/a (P million)	8,211	12,190	18,597	34,790	76,257/b
NA personal consumption/a (P million)	8,368	11,430	17,468	30,778	67,644/b
No. of families (1000)	3,966	4,427	5,132	6,347	6,860
NA personal income/family (P)	2,070	2,754	3,624	5,481	11,116
NA personal consumption/ family (P)	2,110	2,582	3,404	4,849	9,861
NA personal consumption/family (in constant 1965 P/c)	2,929	3,269	3,404	3,030	3,372
FIES average family income(P)/d	1,468	1,803	2,538	3,736	5,840
FIES average family expenditure (P) /e	1,359	1,845	2,903	4,566	6,940
FIES average family expenditure (in constant 1965 P)	1,886	2,335	2,903	2,854	2,373
Ratio of FIES to Na income/ family	0.71	0.65	0.70	0.68	0.53
Ratio of FIES to Na expenditure/ family	0.64	0.71	0.85	0.94	0.70

/a The National Accounts estimates of Personal Income are those reported in Berry (1975) for the years 1957-71.

/b The 1975 figure for NA Personal Income (Consumption) is from Mangahas et al. (1977) adjusted by the ratio of the Berry to Mangahas et al. estimate of 1971 NA Personal Income (Consumption). This allows for the different methodologies used by the two authors, and gives a consistent series for 1957-75.

/c Used CPI (1965=100) to convert the data into consistent terms.

/d As reported in the various FIESs.

/e Computed from the FIES expenditure distribution data.

Table 16. **Average Saving Ratio, by income class, Philippines, 1961, 1965, 1971 and 1975.**

Family Income Group	1961	1965	1971	1975
TOTAL	.006	(.132)	(.199)	(.154)
Under P1000	(.635)	(1.665)	(2.460)	(3.821)
P1000 to P1999	(.139)	(.446)	(.821)	(1.334)
P2000 to P2999	.013	(.162)	(.437)	(.733)
P3000 to P3999	.144	(.091)	(.250)	(.531)
P4000 to P4999	.126	.010	(.164)	(.302)
P5000 to P5999	.138	.001	(.121)	(.251)
P6000 to P7999	.105	.107	(.077)	(.152)
P8000 to P9999	.211	.145	(.022)	(.041)
P10,000 and over	.435	.262	.238	.227

Note: Negative values are in parentheses.

Source of basic data: Family Income and Expenditure Surveys, NCSO

consumption expenditure per family from the FIES data is also lower than the national accounts estimates by a margin of 15% to 30% but this is a smaller degree of understatement compared to the family income estimates Table 16 indicates that there was aggregate dissaving in 1961 and 1965 if we are to believe the income and expenditure figures However this does not appear plausible on the aggregate If a household were a net dissaver another household would have to be a net saver for the income-expenditure identity to hold on the aggregate Even if households were recipients of net transfers from abroad dissaving for the entire number of families is hardly believable It is possible that the extent of income understatement has worsened over time note that seven out of 12 income groups had positive savings ratios in 1961 this decreased to only one out of twelve groups reporting positive savings in 1971

In general expenditure data were more systematically collected than income data First the definitions and questions for the expenditure section remained virtually identical for all FIES Second, there was more probing in the expenditure question and information was sought on a very detailed listing of expenditures For the food beverage and tobacco component which accounts for the major expenditure share the reference period was one week before the survey thus the recall lapse is likely to be minimal

The present study uses expenditure rather than income as an explanatory variable due to the greater degree of reliability of the expenditure data. Also, following World Bank (1980:104), family consumption expenditure may be a better measure of "levels of living" than family income because it is (1) directly related to consumption; (2) constitutes a life cycle measure of welfare, (3) reflects permanent income rather than transitory influences, and (4) avoids the question of savings, dissavings being irrelevant so long as the households have the expectation to pay the loan. Thus, the demand system estimated in a subsequent section is only an expenditure system and does not model savings behavior.

5.2.2 Data Definitions

We were not able to acquire access to raw data tapes from any of the FIES, so we had to use published and unpublished cross-tabulations from the 1961, 1965, 1971 and 1975 FIES. We obtained expenditure data for twelve income classes in the 1961, 1965 and 1971 surveys, and for 17 income classes in the 1975 survey, across eleven regions in the earlier three surveys, and thirteen regions (including the National Capital Region) in the 1975 survey. These data therefore represent cell means. Since the income classes are arbitrary and do not correspond to percentiles in the income distribution, the number of households in each income class is not constant, necessitating the use of the number of households per cell as a weighting variable in the regressions.

The expenditure categories were aggregated into five groups for the purposes of this study: (1) food, beverages and tobacco; (2) housing, household ownership and equipment; (3) clothing and footwear; (4) fuel, light and water, and; (5) miscellaneous, which includes personal and medical care, recreation, household operations (mostly services), gifts and contributions, taxes, personal effects, and miscellaneous goods and services. Expenditure shares for each category were computed, for each region and income class.

Actual prices for 1975 and a regional price differential index were obtained from unpublished computations by the National Accounts Staff of the National Staff of the National Economic and Development Authority (Table 17). Prices for the earlier survey years were computed by deflating using region-specific CPIS. Real family expenditure was obtained by dividing average family expenditure by a price index defined as

$$\tilde{P} = \prod_{i=1}^{n} P_i^{W_i}, \quad \text{or Stone's index.}$$

5.3 Empirical Specification

The FIES data do not include the quantities of the commodities concerned, but expenditures on each item. Thus, flexible functional forms with quantities as dependent variables

Table 17. Regional prices and regional price differential index (RPDI), 1975, Metro Manila = 100.0

Region	Food		Shelter		Clothing		Fuel, Light & Water		Miscellaneous	
	Prices	RPDI	Prices	RPDI	Prices	RPDI	Prices	RPDI	Prices	RPDI
I Ilocos	4.95	78.5	76.45	139.2	12.84	76.2	9.43	186.3	92.23	57.3
II Cagayan	4.68	74.1	33.58	61.1	12.47	74.0	10.25	202.9	59.55	37.1
III C.Luzon	4.92	78.0	45.53	82.9	12.84	76.2	7.69	152.3	88.53	55.1
IV S. Tagalog	4.70	74.5	54.48	99.2	12.82	76.1	9.86	195.2	103.13	64.1
V Bicol	4.26	67.6	49.98	91.0	12.35	73.3	10.54	208.7	75.05	46.6
VI W. Visayas	4.27	67.7	58.88	107.2	13.02	77.3	9.07	180.0	82.41	51.2
VII C. Visayas	4.38	69.5	34.00	61.9	11.06	65.6	8.77	173.6	125.28	77.8
VIII E. Visayas	4.91	77.9	44.49	80.9	13.00	77.1	11.54	228.4	85.27	53.1
IX W. Mindanao	4.46	70.7	40.43	73.1	15.39	91.3	11.60	230.0	75.03	46.6
X N. Mindanao	4.25	67.5	45.91	83.6	13.13	77.9	10.16	200.2	216.14	134.2
XI S. Mindanao	4.90	77.7	49.85	90.8	12.76	75.7	9.63	190.6	68.60	62.6
XII C. Mindanao	4.39	69.6	42.25	76.9	12.01	71.3	11.00	217.6	93.78	58.2
XIII NCR	6.31	100.0	54.92	100.0	16.85	100.0	5.05	100.0	161.00	100.0
PHILIPPINES	4.85	76.9	51.28	93.3	13.49	80.0	8.77	173.7	109.81	68.2

Basic Data Source: National Accounts Staff, NEDA (1987).

cannot be estimated using this data set However, since expenditure shares are easily computed, the translog functional form was used Two basic variants of the translog demand function were used

$$(5\ 2)\quad S_i = a_i + b_{i1}\log m + b_{i2}(\log m)^2 + \sum_{j=1}^{n} C_{ij}\log P_j + \delta_{ij} t_j + \sum_{h=1}^{2} \varepsilon_{ih}\, REG_h + u_i$$

and

$$(5\ 3)\quad S_i = a_i + b_{i1}\log m + \sum_{i=1}^{n} C_{ij}\log P_j + \delta_{ij} t_j + \sum_{h=1}^{2} \varepsilon_h REG_h + u_i,$$

where $S_i = \dfrac{X_i P_i}{\sum_{i=1}^{h} X_i P_i}$ or the expenditure share of commodity i

m = real expenditure defined as average family expenditure divided by the price index, or $\frac{M}{\tilde{P}}$ where $\tilde{P} = \prod_{i=1}^{p} W_i P_i$

P_j = price of commodity j

t = time

REG_h = dummy variable for region where $REG_1 = 1$ for Luzon and $REG_2 = 1$ for Visayas, and 0 otherwise

log = natural logarithm and

u_i = error term

Thus variant 1 has a quadratic real expenditure term while the other is linear in the natural logarithm of real expenditure. For each of these two variants, two alternative price indices were used: (1) actual regional prices (or a weighted average of actual prices in a particular region); and (2) regional price indices with Metro Manila prices in 1975 taken as the base.

Adding-up was imposed (and cannot be tested) by dropping one equation, while symmetry was imposed across equations by restricting $C_{ij} = C_{ji}$. The homogeneity restriction was also imposed. Both constrained and unconstrained estimates were obtained.

The estimation procedure used was Zellner's (1963) seemingly unrelated regressions (SUR) procedure. The equation for miscellaneous items was dropped to avoid singularity of the variance-covariance matrix. As mentioned above, the number of households in each income group was used as the weighting variable. The results are presented in the next chapter.

CHAPTER VI
ESTIMATION RESULTS

Following the format of the previous section, we present the results for the food subsystem and the entire expenditure system separately.

6.1 Food Subsystem

Prior to the estimation of the separate regressions for each island group, a test for equality of variances across island groups was performed. The test statistic used was:

$$(6.1)\quad F_{n_i-k_i,n_j-k_j} = \frac{(\text{Sum of Squared Residuals})_i/(n_i-k_i)}{(\text{Sum of Squared Residuals})_j/(n_j-k_j)} \qquad i \neq j$$

where i and j are indices for different regressions corresponding to different island groups; n_i and n_j are the sample sizes of the i^{th} and j^{th} island group, respectively; and k_i and k_j are the number of parameters in each equation. Since the same functional form is used for all island groups, $k_i = k_j$.

Computed F statistics and critical values at $\alpha = 0.05$ are shown in Table 18. The results show that variances are not equal across island groups, justifying separate regressions. However, the inequality of error variances between groups (pairwise tests)

Table 16. Tests for equality of variance between island groups.

Commodity	$H_o:\sigma^2_{LUZ}=\sigma^2_{PHIL}$ a*/	$H_o:\sigma^2_{VIS}=\sigma^2_{PHIL}$ a*/	$H_o:\sigma^2_{MIN}=\sigma^2_{PHIL}$ c*/	$H_o:\sigma^2_{LUZ}=\sigma^2_{VIS}$ d*/	$H_o:\sigma^2_{MIN}=\sigma^2_{VIS}$ e*/
Rice	0.80	1.11	1.22	0.72	1.1
Corn	0.22	1.72	2.28	0.13	1.32
Rice & Corn Products	1.03	0.71	1.19	1.44	1.68
Other Cereal Products	1.17	0.87	0.62	1.27	0.71
Starchy Roots & Tubers	1.26	0.34	0.68	3.69	1.98
Sugars & Syrups	1.04	1.14	0.49	0.92	0.43
Fats & Oils	1.36	0.30	0.31	4.52	1.02
Fish	0.97	1.09	0.77	0.89	0.71
Meat	1.20	0.57	0.68	2.12	1.19
Poultry	1.19	0.72	0.39	1.67	0.55
Eggs	1.21	0.75	0.78	1.49	1.03
Dairy	1.30	0.46	0.38	2.80	0.82
Dried Beans, Nuts & seeds	1.15	0.76	0.63	1.52	0.84
Vegetables	1.06	0.59	1.06	1.79	1.78
Fruits	1.02	1.01	0.76	1.02	0.76
Miscellaneous	0.65	2.06	0.56	0.31	0.27

a* Critical F at .05= 1.07
b* Critical F at .05= 1.02
c* Critical F at .05= 1.00
d* Critical F at .05= 1.0[illegible]
e* Critical F at .05=

is statistically significant for some commodities and not for others. For example, in the case of rice, the error variances of the Luzon regression and the pooled Philippine regression are not significantly different, unlike those of Visayas and Mindanao vis-a-vis the entire Philippines. This indicates that Visayas and Mindanao rice consumption patterns may be different from the "average" Philippine pattern which closely follows that of Luzon. The same divergence of Visayas and Mindanao error variances from the pooled regression variance is also evident for corn. This supports our hypothesis of regional variations in cereal consumption patterns. In contrast, Luzon consumption patterns seem to differ from the Philippine trend for such commodities as other cereal products, starchy roots and tubers, fats and oils, meat, poultry, eggs, dairy, and legumes. Given the resu... Table 18, we proceed to estimate equation (5.1) separatel each island group.

6.1.1 Tobit Estimation Results

Maximum likelihood tobit estimates for the three isla groups and for the pooled Philippine data are shown in Tab to 22.

The results show a considerable degree of responsiveness, especially for the Luzon regressions (Tab All except one of the coefficients with respect to the ow are significant at the 5% level, as well as 95 cros

Table 19. Tobit results for Luzon, pooled 1978 and 1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers
a+					
Intercept	13073.00	-1176.10	-415.06	-2.64	-21108.00
Prices					
Rice	-2366.20 **	-8.10	77.74	214.77	-1185.70
Corn	-1386.70 **	-1473.20	220.44	80.31	2865.00**
Rice & Corn Prodts	1141.90 **	-545.10	-2831.40**	-153.26 *	66.62
Other Cereal Prodts	1137.10 **	-130.48	131.44	-1415.00 **	183.94
Starchy Roots & Tubers	-71.41	-218.65	700.41**	386.29 **	-6192.40**
Sugars & Syrups	-682.22 **	274.39	770.18**	236.97 **	716.30
Fats and Oils	226.54	-817.25	-46.72	97.49	82.61
Fish	-229.23	-952.52	158.19	245.17 **	870.20
Meat	746.61 **	-822.11	-370.83**	-7.94	-428.33
Poultry	-144.47	-1360.00	16.08	46.95	-339.95
Eggs	1612.10**	-1084.80	-143.01	-297.60 *	245.66
Dairy	159.43	-194.38	-40.31	82.84	977.61
Dried Beans, Nuts, and Seeds	140.53	-504.78	-171.33	-21.52	646.72
Vegetables	-541.97 **	-75.86	273.67	298.09 **	184.59
Fruits	71.77	-105.95	-89.88	138.85 **	542.88
Miscellaneous	-281.84 **	-182.53	238.08**	272.88 **	-780.25*
Food Expenditure	5711.90 **	-1209.90	654.12**	626.56 **	3350.60**
URB 1	-966.42 **	231.28	11.96	275.34 *	730.01
URB 2	275.21	187.22	-152.69	-58.17	316.83
RUR 1	1364.90 **	350.90	-210.68	-387.20 **	837.91
RUR 2	1622.10 **	-538.03	-352.87	-211.58 *	-966.03
YEAR	1007.40 *	403.22	167.18	124.63	276.05
SIGMA	4634.20 **	12647.00 **	3015.70**	1584.50 **	13984.00**
Slopes=0 b+	1111.90	118.46	873.57	1205.60	945.62
Homogeneity c+	1.99	0.15	0.51	1.40	0.68

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
   * indicates significance at alpha=0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
   All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
   Chi-squared 1df at 0.05 significance is 3.84.
   Homogeneity assumption (null hypothesis) accepted.

Table 19. Tobit results for Luzon, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat	Q10 Poultry
a+					
Intercept	-3373.30	-1561.20	-11147.00	-5042.10	1095.60
Prices					
Rice	87.60	195.16*	-688.53**	493.71	300.97
Corn	154.30	70.12	112.58	227.67	344.24
Rice & Corn Prodts	-145.90 *	-23.00	-229.61	138.44	-116.80
Other Cereal Prodts	59.11	-293.39**	-210.38	166.42	115.69
Starchy Roots & Tubers	95.13	119.70	501.82**	1160.90**	1389.70**
Sugars & Syrups	-324.43 **	151.02*	77.11	439.62*	518.11
Fats and Oils	-0.09	-992.74**	285.43*	122.85	-50.06
Fish	238.32**	261.82**	-1504.60**	574.10**	492.08
Meat	103.09	43.17	691.24**	-2186.00*	-411.67
Poultry	83.58	-120.47	551.96*	61.61	-3114.90**
Eggs	-147.22	341.03*	316.68	-572.45	-1019.10
Dairy	-1.44	92.42	104.61	219.83	-154.48
Dried Beans, Nuts, and Seeds	-57.95	38.31	39.38	-396.08 *	-178.53
Vegetables	116.97*	174.79**	351.14**	1105.40 **	821.07**
Fruits	113.45*	107.12	506.08**	21.61	14.60
Miscellaneous	333.39**	150.03**	234.16**	805.69 **	568.21**
Food Expenditure	1151.40**	729.15**	3878.00**	1587.00 **	-4.54
URB 1	152.01	-74.85	753.41	230.34	141.66
URB 2	-87.35	-93.38	308.50	-422.50	-405.29
RUR 1	-212.11*	-119.35	-414.73	-95.28	-355.52
RUR 2	-206.94*	-152.14	583.84**	-812.16 **	-782.75
YEAR	-498.10**	-99.17	-75.70	-1150.50 *	-39.98
SIGMA	1596.00**	1703.80**	3615.80**	4502.40 **	5302.50**
Slopes=0 b+	580.78	620.52	824.63	855.10	672.57
Homogeneity c+	1.80	1.81	1.91	1.00	0.34

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
* indicates significance at alpha=0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
Chi-squared 1df at 0.05 significance is 3.84.
Homogeneity assumption (null hypothesis) accepted.

Table 19. Tobit results for Luzon, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.
a+						
Intercept	-5.06	312.00	-795.49	-21892.00	-18388.00	-962.24
Prices						
Rice	21.08	435.69	94.08	-1736.50**	842.19	539.21*
Corn	-151.45 *	461.26	-80.08	-585.53**	868.42*	174.65
Rice & Corn Prodts	-8.17	-24.59	90.13	-218.04	-735.60*	-117.23
Other Cereal Prodts	12.11	-178.38	18.42	658.11 **	-685.07	-32.12
Starchy Roots & Tubers	233.36 **	689.60 **	149.46**	-326.51 *	1949.10**	242.83*
Sugars & Syrups	150.42 **	791.42 **	19.47	84.79	175.82	131.34
Fats and Oils	34.89	-37.32	-123.77**	510.70 **	-100.25	72.27
Fish	310.55 **	609.27*	151.23*	632.57 **	1126.20**	26.06
Meat	87.31	-127.99	69.09	621.96 *	17.31	28.11
Poultry	-152.96 *	-1331.60**	4.61	483.60	248.02	-356.52*
Eggs	-1017.80 **	-224.40	7.66	1489.90 **	-1802.30	-362.71
Dairy	-59.47	-2053.70**	-26.49	411.74 *	483.23	-48 00
Dried Beans, Nuts, and Seeds	-52.69	-390.72	-728.77**	163.08	55.81	-26.00
Vegetables	182.50 **	672.17**	406.17**	-3341.10 **	815.69**	-204.98*
Fruits	104.49 *	108.25	-108.60*	178.94	-5271.80**	115.31
Miscellaneous	129.52 **	594.13**	82.60**	459.90 **	814.34 **	-379.85**
Food Expenditure	520.76 **	1426.90**	226.81**	6115.70 **	7630.20 **	1045.1[illegible] **
URB 1	49.83	-72.75	133.78	-576.31	1045.00	-102.37
URB 2	253.23 **	-576.74	-110.23	-109.19	-513.20	-47.08
RUR 1	141.19	-25.37	5.98	201.58	-1287.80*	167.11
RUR 2	496.60 **	-1153.00**	-157.53	-246.99	-629.96	-120.62
YEAR	94.07	938.14	-11.47	961.17 *	268.93	-0.78
SIGMA	1276.30 **	5900.80**	1550.00**	4186.10 *	8129.00*	2091.90**
Slopes=0 b+	643.80	446.75	234.90	1715.40	1707.90	362.73
Homogeneity c+	1.01	1.20	0.98	1.95	1.30	1.99

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
 * indicates significance at alpha=0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
Chi-squared 1df at 0.05 significance is 3.84.
Homogeneity assumption (null hypothesis) accepted.

lasticities (the insignificant own price term is that of orn) Except for corn and poultry the food expenditure coefficients are significant However not all the occupational dummies are significant RUR2 the occupational dummy for agricultural laborers is negative and significant for five equations (other cereal products sugars and syrups meat eggs, and dairy) but significantly positive for rice and fish The dummy for farm owners RUR1 is positively significant for rice but negative for other cereal products sugars and syrups and fruits Finally the urban professional group dummy is positive for other cereal products and fish but negative for rice and vegetables This indicates income and occupational variations in consumption patterns

In the Visayas regressions (Table 20) fifteen out of sixteen own-price coefficients are significant at the 5% level (corn is the exception) while 61 cross-price coefficients are significant for only 10 out of 16 equations the exceptions being corn, rice and corn products roots meat poultry and dairy products Once again, not all the occupational dummies are significant The URB2 (urban semi-skilled) variable is significantly negative for two commodities (fats and oils eggs), he RUR1 (farm owners) positive for rice and negative for fats and oils and RUR2 (agricultural labor) negative for fats and oils meat, eggs and fruits

Table 20. Tobit results for Visayas, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	011 Eggs	012 Dairy	013 Dried Beans Nuts, Seeds	014 Vegetables	015 Fruits	016 Misc.
a+						
Intercept	-210.48	969.95	-477.70	-9679.40	-29195.00	-9932.30
Prices						
Rice	-70.16	-102.37	-322.99	-959.05	-430.33	552.82
Corn	-65.44	-220.17	-135.59	-426.02	-107.95	-1524.50*
Rice & Corn Prodts	178.70*	152.29	56.24	230.51	412.58	299.22
Other Cereal Prodts	-21.62	-62.24	44.42	591.68*	-65.59	-27.42
Starchy Roots & Tubers	241.73 **	739.91**	166.43	252.02	955.95	826.21*
Sugars & Syrups	92.08	396.55	127.47	58.84	31.35	84.49
Fats and Oils	-23.34	396.41	175.62	-33.52	259.63	410.73
Fish	398.13 **	-2.04	334.49 **	797.27**	1330.60*	244.77
Meat	-218.23 *	-78.24	-10.69	304.73	167.08	-710.70*
Poultry	-180.42	-252.10	-478.90 **	331.30	373.29	1055.80*
Eggs	-849.75 **	-530.71	-170.83	-544.18	931.98	567.22
Dairy	-91.44	-1803.60**	57.20	226.26	-435.74	30.58
Dried Beans, Nuts and Seeds	-280.84**	-217.61	-749.73 **	-207.05	479.86	-256.49
Vegetables	329.87**	405.72	81.80	-2354.50**	711.58	230.37
Fruits	-5.89	84.06	-44.69	41.65	-5088.00**	-238.47
Miscellaneous	358.23 **	737.62**	165.37 **	264.14**	715.53*	-1088.00*
Food Expenditure	602.50 **	574.88	483.28 **	4006.10**	7554.90**	2987.10*
URB 1	146.44	-149.98	147.77	-22.31	-437.24	-141.23
URB 2	-340.33 *	-383.95	-210.68	-260.73	-958.70	-185.45
RUR 1	-279.49	-519.45	9.52	81.18	-262.45	326.09
RUR 2	-454.73 **	-594.36	-232.44	-352.95	-1698.20	-139.25
YEAR	-127.86	1847.30	332.96	-110.74	1100.00	305.02
SIGMA	1233.20 **	4084.10**	1368.40 **	3250.80 **	8744.20**	3739.60*
Slopes=0 b+	325.56	222.78	110.06	622.34	598.00	266.60
Homogeneity c+	0.76	0.94	0.87	1.66	1.15	1.98

a+ ** indicates significance at alpha=0.01, critical t is 2.82
* indicates significance at alpha= 0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63
Chi-squared 1df at 0.05 significance is 3.84.
Homogeneity assumption (null hypothesis) accepted.

Table 20. Tobit results for Visayas, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat	Q10 Poultry
a+ Intercept	-3847.00	499.45	-12071.00	-1837.90	-239.94
Prices					
Rice	87.17	-85.01	-1039.90**	391.09	-21.63
Corn	-194.79	77.50	-306.01	-227.44	393.32
Rice & Corn Prodts	243.28	206.62*	-295.90	263.24	-164.73
Other Cereal Prodts	-35.08	-219.97*	299.93	-161.17	255.44
Starchy Roots & Tubers	383.24**	49.52	697.13 **	864.98**	792.55
Sugars & Syrups	-573.73**	-52.07	89.43	704.59*	74.30
Fats and Oils	-141.82	-613.85 **	15.31	372.57	-356.49
Fish	409.90**	189.93 **	-2559.30**	393.21	277.22
Meat	-18.52	39.57	838.98*	-2270.40**	-384.73
Poultry	-84.41	-52.12	-37.83	-640.66	-1760.20*
Eggs	-393.82	-444.05 **	193.00	670.41	-805.81
Dairy	117.10	47.04	1143.00 **	-212.51	14.61
Dried Beans, Nuts, and Seeds	-130.62	-132.51	-56.51	-823.82*	-224.85
Vegetables	306.88**	114.79 **	744.39 **	962.21**	294.25
Fruits	1.17	80.88	637.72 **	388.68	186.57
Miscellaneous	608.20 **	136.32 **	284.31 **	882.79**	604.42
Food Expenditure	1412.20**	542.32 **	4920.30 **	743.31	-506.88
URB 1	317.01	82.72	125.57	-198.00	-24.59
URB 2	89.36	-157.50	-71.47	-494.68	293.09
RUR 1	-316.30	-220.20	-216.02	-509.03	-136.56
RUR 2	-153.66	-260.02 **	-41.57	-1106.90*	-363.22
YEAR	-697.37*	297.13	-835.03	-285.51	-145.03
SIGMA	1853.50**	900.81 **	3772.70 **	4240.60**	5779.70 **
Slopes=0 b+	286.17	315.10	541.49	313.63	129.91
Homogeneity c+	1.47	1.54	1.94	0.69	0.25

a+ ** indicates significance at alpha=0.01. critical t is 2.82
* indicates significance at alpha= 0.05. critical t is 2.07

b+ All equations found significant at alpha= 0.01. chi-squared 22df is 40.3.
All equations found significant at alpha= 0.05. chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
Chi-squared 1df at 0.05 significance is 3.84.
Homogeneity assumption (null hypothesis) accepted.

Table 20. Tobit results for Visayas, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	011 Eggs	012 Dairy	013 Dried Beans Nuts, Seeds	014 Vegetables	015 Fruits	016 Misc.
a+						
Intercept	-210.48	969.95	-477.70	-9679.40	-29195.00	-9932.30
Prices						
Rice	-70.18	-102.37	-322.99	-959.05	-430.33	552.82
Corn	-65.44	-220.17	-135.59	-426.02	-107.95	-1524.50**
Rice & Corn Prodts	178.70*	152.29	56.24	230.51	412.58	299.22
Other Cereal Prodts	-21.62	-62.24	44.42	591.68*	-65.59	-27.42
Starchy Roots & Tubers	241.73 **	739.91**	166.43	252.02	955.95	826.21**
Sugars & Syrups	92.08	396.55	127.47	58.84	31.35	84.49
Fats and Oils	-23.34	396.41	175.62	-33.52	259.63	410.73
Fish	398.13 **	-2.04	334.49 **	797.27**	1330.60*	244.77
Meat	-218.23 *	-78.24	-10.69	304.73	167.08	-710.70*
Poultry	-180.42	-252.10	-478.90 **	331.30	373.29	1055.80*
Eggs	-849.75 **	-530.71	-170.83	-544.18	931.98	567.22
Dairy	-91.44	-1803.60**	57.20	226.26	-435.74	30.58
Dried Beans, Nuts, and Seeds	-280.84**	-217.61	-749.73 **	-207.05	479.86	-256.49
Vegetables	329.87**	405.72	81.80	-2354.50**	711.58	230.37
Fruits	-5.89	84.06	-44.69	41.65	-5088.00**	-238.47
Miscellaneous	358.23 **	737.62**	165.37 **	264.14**	715.53*	-1088.00**
Food Expenditure	602.50 **	574.88	483.28 **	4006.10**	7554.90**	2987.10**
URB 1	146.44	-149.98	147.77	-22.31	-437.24	-141.23
URB 2	-340.33 *	-383.95	-210.68	-260.73	-958.70	-185.45
RUR 1	-279.49	-519.45	9.52	81.18	-262.45	326.09
RUR 2	-454.73 **	-594.36	-232.44	-352.95	-1698.20	-139.25
YEAR	-127.86	1847.30	332.96	-110.74	1100.00	305.02
SIGMA	1233.20 **	4084.10**	1368.40 **	3250.80 **	8744.20**	3739.60**
Slopes=0 b+	325.56	222.78	110.06	622.34	598.00	266.60
Homogeneity c+	0.76	0.94	0.87	1.86	1.15	1.98

a+ ** indicates significance at alpha=0.01, critical t is 2.82
 * indicates significance at alpha= 0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
 All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
 Chi-squared 1df at 0.05 significance is 3.84.
 Homogeneity assumption (null hypothesis) accepted.

The most disappointing performance is shown by the Mindanao regressions (Table 21) Only 12 out of 16 own-price coefficients and 10 out of 16 food expenditure coefficients are significant at the 5% level while only 35 of the cross-price terms are significant also at 5% With regard the occupational dummies only the variable for agricultural laborers is significant and negative for two commodities other cereal products and eggs

Finally Table 22 shows the results of the pooled Philippine regression Fifteen out of sixteen own-price coefficients are significant at the 5% level (with the exception of corn) likewise 15 out of 15 food expenditure coefficients are significant (with the exception of poultry) and 105 cross-price terms are significant The URB1 (professional urban workers) coefficient is negative for rice and vegetables, but positive for sugars and syrups and fish The URB2 (semi-skilled workers) term is significantly negative for meat eggs, dairy, beans and seeds and fruits For the rural occupational groups, the farm owner dummy (RUR1) is significant and positive for rice but negative for other cereal products sugars and syrups, fish eggs and fruits The RUR2 (agricultural labor) dummy is likewise positive for rice and fish and negative for rice and corn products, other cereal products sugars and syrups, fats and oils, meat eggs dairy dried beans vegetables and fruits

Tests for significance of the overall regression (Ho $\beta_1 = 0$

Table 21. Tobit results for Mindanao, pooled 1978 and 1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers
a+ Intercept	-4882.70	-15118.00	-88.22	1107.46	-9282.00
Prices					
Rice	-8108.90 **	6401.60	-66.01	223.91	544.43
Corn	-2765.40	895.60	297.41	-284.01	874.39
Rice & Corn Prodts	-1640.50 **	3357.10*	-1901.80**	-39.01	-379.61
Other Cereal Prodts	1826.40 *	-932.62	-135.07	-1481.00**	-567.91
Starchy Roots & Tubers	41.30	950.93	465.24	193.85	-5728.20**
Sugars & Syrups	-237.18	-195.71	211.94	537.02**	174.42
Fats and Oils	-146.19	-430.02	-156.03	5.21	-1010.70
Fish	543.66	-246.82	10.63	496.16**	-30.22
Meat	-94.67	611.93	34.33	-232.89	735.03
Poultry	-636.19	400.38	-454.20	185.97	-1014.70
Eggs	730.25	2621.60	-232.49	-612.10	325.12
Dairy	1666.10	-1670.90	-566.93	-80.57	-1028.80
Dried Beans, Nuts, and Seeds	7.71	-6.25	-111.41	-185.50	-14.38
Vegetables	899.21 *	-1284.20	600.91	348.24**	-55.66
Fruits	1474.20 **	-1808.00	225.09	283.39*	-10.17
Miscellaneous	-62.70	-1914.30*	651.06 *	365.22**	-1030.20
Food Expenditure	5258.50**	-376.24	283.50	522.00*	3213.70
URB 1	-904.85	1054.80	105.73	-395.47	-489.04
URB 2	812.22	-608.79	64.69	-33.17	471.69
RUR 1	338.74	747.41	-87.22	-126.03	708.66
RUR 2	-374.87	2329.00	-557.14	-612.09**	937.73
YEAR	1639.30	-4015.00	687.62	210.80	2695.10
SIGMA	6439.10**	13148.00 **	3805.60 **	1555.30**	11398.00**
Slopes=0 b+	234.45	194.57	76.01	281.84	219.05
Homogeneity b+	1.75	0.66	0.38	1.01	0.61

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
* indicates significance at alpha=0.05, critical t is 2.07
b+ All equations found significant at alpha= 0.01, chi-squared 22df=40.3.
All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.
c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
Chi-squared 1df at 0.05 significance is 3.84.
Homogeity assumption (null hypothesis) accepted.

Table 21. Tobit results for Mindanao, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat	Q10 Poultry
a+					
Intercept	-914.17	839.53	-2360.90	1963.20	1642.40
Prices					
Rice	53.62	-68.64	-207.08	487.75	104.57
Corn	-403.12	-328.61	-927.53	-71.16	-175.17
Rice & Corn Prodts	-72.06	59.92	-88.20	-229.98	158.19
Other Cereal Prodts	-145.84	-224.85 *	168.58	538.49	-352.74
Starchy Roots & Tubers	31.96	68.25	122.03	688.84 *	115.90
Sugars & Syrups	-168.17	23.35	-52.78	400.32	96.97
Fats and Oils	-39.99	-439.78 **	604.24 *	194.19	-92.16
Fish	223.75*	140.30	-1674.50 **	488.97	-612.62
Meat	6.89	-75.10	-11.61	-2514.50 **	-391.61
Poultry	13.93	-284.39	-522.10	-69.60	-1367.70
Eggs	-203.03	-260.70	-1351.80	-1906.50	-193.57
Dairy	-226.58	119.13	531.95	137.05	-173.12
Dried Beans, Nuts, and Seeds	-5.18	-6[illegible].65	473.52	-650.10	-303.45
Vegetables	194.48*	22.05	931.17 **	378.18	25.85
Fruits	208.09*	14.41	195.78	447.93	-149.44
Miscellaneous	477.35**	256.78 **	88.74	1039.30 **	69.85
Food Expenditure	687.94**	495.23 **	3409.00 **	1065.40	-535.88
URB 1	-15.90	-0.56	-3.73	-635.07	275.38
URB 2	-109.57	-108.35	427.67	-483.23	-358.36
RUR 1	-167.06	-30.13	-222.33	105.86	28.20
RUR 2	-326.01	-57.58	-154.89	-664.10	-0.37
YEAR	103.11	408.00	777.70	-517.74	94.85
SIGMA	1245.40**	846.84 **	3178.60 **	4146.80 **	5167.90**
Slopes=0 b+	169.98	182.45	234.09	222.52	55.89
Homogeneity b+	1.47	1.65	1.92	0.78	0.21

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
  * indicates significance at alpha=0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df=40.3.
  All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
  Chi-squared 1df at 0.05 significance is 3.84.
  Homogeity assumption (null hypothesis) accepted.

Table 21. Tobit results for Mindanao, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.
a+ Intercept	1705.00	-1579.00	817.87	-23788.00	-15405.00	-1134.00
Prices						
Rice	-148.94	-227.69	-82.98	-222.68	-1164.70	-289.30
Corn	38.18	899.93	195.86	648.32	409.31	-552.16
Rice & Corn Prodts	-239.54*	-306.17	154.59	-149.44	-685.66	-238.39
Other Cereal Prodts	-205.91	-252.29	-260.49	-297.22	440.09	-73.40
Starchy Roots & Tubers	-79.64	307.20	144.10	312.91	710.50	-91.90
Sugars & Syrups	134.82	291.46	57.18	580.96	-538.50	564.97*
Fats and Oils	-201.86	87.80	-144.57	-270.82	602.01	165.55
Fish	528.14	478.73	209.01*	1361.60**	1152.00*	-40.43
Meat	-246.12	-328.19	-116.88	843.87	-295.30	133.78
Poultry	-22.62	203.03	-55.42	761.72	-7.57	56.83
Eggs	-1195.80**	-795.04	-311.94	1729.80	-3138.30	-432.08
Dairy	-108.96	-356.72	-191.16	795.40	1185.50	-186.54
Dried Beans, Nuts, and Seeds	-8.25	190.80	-521.38**	66.29	368.45	-211.85
Vegetables	374.36**	413.37	199.51*	-2662.70	-333.19	201.34
Fruits	89.76	65.02	-50.73	-214.94	-4713.00**	-149.06
Miscellaneous	305.56**	871.04**	143.45*	749.86 **	746.49*	-487.41**
Food Expenditure	398.37*	751.66	333.78*	5522.40 **	6294.10**	1271.10**
URB 1	2.02	-122.44	67.66	-180.95	-298.56	231.02
URB 2	-232.31	-495.94	-132.62	-484.59	-382.59	-80.95
RUR 1	33.93	-335.85	-143.87	-233.74	143.31	109.87
RUR 2	-475.19*	-946.50	-196.05	-832.75	-1120.50	-122.02
YEAR	442.19	-1099.60	460.39	-1087.80	-342.74	1137.40
SIGMA	1174.00**	3639.30**	1123.90**	4306.60**	7503.70**	1917.40**
Slopes=0 b+	183.27	132.95	73.41	324.62	296.03	130.34
Homogeneity b+	0.84	0.99	1.01	1.85	1.10	2.00

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
  * indicates significance at alpha=0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df=40.3.
  All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
  Chi-squared 1df at 0.05 significance is 3.84.
  Homogeity assumption (null hypothesis) accepted.

Table 22. Tobit results for Philippines pooled 1978 and 1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers
a+					
Intercept	-17222.00	2656.40	-345.40	66.60	-18820.00
Prices					
Rice	-4413.70**	2939.50	6.91	197.31	-932.27
Corn	-1033.70**	-1710.40	250.52	63.94	2356.10 **
Rice & Corn Prodts	-166.71	629.34	-2624.00 **	15.25	357.73
Other Cereal Prodts	1386.20**	-163.72	17.53	-1525.40**	48.83
Starchy Roots & Tubers	286.18**	-1410.20 *	687.83**	299.47**	-5583.00 **
Sugars & Syrups	-221.36	-309.93	650.88**	336.60**	329.53 **
Fats and Oils	278.50	-718.24	-94.60	116.64*	-293.28
Fish	195.41	-1154.20	204.39	307.94**	748.68
Meat	447.91*	42.72	-333.70**	-33.72	-448.83
Poultry	720.94*	-1618.80	-144.94	-39.71	-487.19
Eggs	2345.10**	-969.53	-223.74	-401.31**	468.59
Dairy	-16.39	536.47	-97.25	23.23	561.01
Dried Beans, Nuts, and Seeds	64.80	215.43	-107.37	-103.08	308.12
Vegetables	-360.46**	-60.89	291.68**	304.84 **	-0.59
Fruits	1046.70**	-3028.50 **	125.98	207.94**	714.78
Miscellaneous	37.66	-2921.70 **	267.65**	330.15 **	-461.62
Food Expenditure	6323.20**	-2221.60 *	638.59**	702.59**	2986.00**
URB 1	-1187.70**	441.59	6.18	166.70	420.67
URB 2	97.38	430.40	-74.10	-100.04	286.72
RUR 1	1359.60 **	438.58	-275.69	-408.48 **	576.08
RUR 2	1083.30 **	783.75	-381.26*	-281.78**	-546.07
YEAR	215.14	627.49	98.81	165.70	396.55
SIGMA	5407.50 **	15369.00**	3170.80**	1587.10**	13414.00**
Slopes=0 b+	1458.10	799.14	1033.20	2001.60	1315.40
Homogeneity c+	1.92	0.32	0.48	1.29	0.63

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
   * indicates significance at alpha= 0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
   All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
   Chi-squared 1df at 0.05 significance is 3.84.
   Homogeneity assumption (null hypothesis) accepted.

Table 22. Tobit results for Philippines, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	06 Sugars & Syrups	07 Fats & Oils	08 Fish	09 Meat	010 Poultry
a+					
Intercept	-3050.30	-1058.80	-9290.60	-3916.70	925.40
Prices					
Rice	86.62	127.72 *	-670.16 **	572.87	244.76
Corn	486.20	102.68	-80.56	232.46	493.88
Rice & Corn Prodts.	-21.88	78.65	-356.32 **	249.14	-19.76
Other Cereal Prodts	-34.95	-312.21 **	-109.02	50.70	121.28
Starchy Roots & Tubers	168.33 **	127.32 **	448.33 **	1273.70 **	1442.80 **
Sugars & Syrups	-428.25	85.14	71.93	545.97 **	548.73 *
Fats and Oils	-30.75	-900.02 **	307.25 **	295.72	-188.89
Fish	296.04 **	306.55 **	-1854.20 **	822.79 **	385.53
Meat	59.61	12.31	652.41 **	-2530.40 **	-555.10 *
Poultry	-6.38	-159.08 *	439.48 *	-134.90	-2976.60 **
Eggs	-293.87 *	156.64	-229.15	-669.51	-1038.60
Dairy	-7.41	54.03	435.16 **	-92.58	-129.71
Dried Beans, Nuts, and Seeds	-77.42	-42.57	343.04	-675.43 **	-260.10
Vegetables	184.01 **	144.95 **	622.52 **	1102.40 **	716.78 **
Fruits	128.28 **	140.10 **	325.43 **	119.76	197.98
Miscellaneous	411.04 **	186.72 **	134.15 **	226.32	807.67
Food Expenditure	1208.40 **	708.62 **	3644.50 **	1600.10	-342.05
URB 1	168.63 *	-7.77	603.65 **	111.74	126.75
URB 2	-63.42	-117.77	239.27	-509.27 *	-439.10
RUR 1	-264.15 **	-155.36	-382.97 *	-162.14	-279.41
RUR 2	-261.80 **	-213.56 **	369.41 **	-1180.90 **	-657.00
YEAR	-419.11 **	-23.49	74.04	-1253.60 **	137.87
SIGMA	1622.30 **	1501.60 **	3665.10 **	4084.70 **	5735.40 **
Slopes=0 b+	1003.60	971.99	1489.10	1343.70	826.13
Homogeneity c+	1.68	1.73	1.92	0.90	0.30

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
 * indicates significance at alpha= 0.05, critical t is 2.07

b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
 All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.

c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
 Chi-squared 1df at 0.05 significance is 3.84.
 Homogeneity assumption (null hypothesis) accepted.

Table 22. Tobit results for Philippines, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.
a+ Intercept	-95.07	813.53	-568.71	-20888.00	-19678.00	-2538.50
Prices						
Rice	-57.44	301.88	-29.82	-1594.30**	320.84	501.36**
Corn	-143.70*	462.86	-76.92	-599.21*	1175.90**	30.08
Rice & Corn Prodts	46.75	-75.23	106.17 *	476.76**	-410.65	-55.50
Other Cereal Prodts	21.42	-249.63	-20.81	527.92**	-682.24*	-86593.00
Starchy Roots & Tubers	181.27**	770.36**	192.10 **	-111.25	2170.30**	254.48**
Sugars & Syrups	142.78**	656.66**	44.75	148.44	196.22	143.13
Fats and Oils	2.94	41.51*	-86.47	308.04	-132.86	163.31
Fish	352.22**	527.13**	193.33 **	915.01*	1242.90**	7.29
Meat	33.04	-231.13	18.27	597.00**	-215.30	-69.05
Poultry	-233.36 **	-1099.50**	-59.57	207.55	-5.55	-28.94
Eggs	-1203.10	-495.67**	-60.94	1626.90**	-1640.10*	-379.68
Dairy	-44.22	-1978.20**	-26.60	217.07	-563.24	20.77
Dried Beans, Nuts, and Seeds	-63.99	-324.28	-700.16 **	-6.84	-102.31	-60.96
Vegetables	208.61 **	669.25**	307.43 **	-3004.50**	622.59**	-217.27**
Fruits	-1.27	168.70	-78.14 *	559.16**	-5611.40**	-35.69
Miscellaneous	250.43**	951.41**	106.84 **	586.78**	1273.30**	-589.50**
Food Expenditure	677.75 **	1126.70**	281.10 **	5704.90**	8065.60**	1484.20**
URB 1	-30.15	-86.31	116.75	-545.55*	525.57	18.87
URB 2	-360.17 **	-538.66*	-132.65 *	-210.88	-689.97*	-66.78
RUR 1	-303.88 **	-207.36	-5.45	226.07	-1000.80*	143.29
RUR 2	-615.90 **	-1098.40**	-184.57 *	-379.24*	-1126.80**	-94.64
YEAR	108.12	1102.20*	117.89	395.81	335.15	274.06
SIGMA	1281.80 **	5755.60**	1468.00 **	4122.10 **	8135.30**	2605.50**
Slopes=0 b+	1108.70	699.54	349.18	2636.50	2494.60	687.49
Homogeneity c+	0.93	1.11	0.96	1.91	1.24	1.99

a+ ** indicates significance at alpha= 0.01, critical t is 2.82
* indicates significance at alpha= 0.05, critical t is 2.07
b+ All equations found significant at alpha= 0.01, chi-squared 22df is 40.3.
All equations found significant at alpha= 0.05, chi-squared 22df is 33.9.
c+ Likelihood ratio test. Chi-squared 1df at 0.01 significance is 6.63.
Chi-squared 1df at 0.05 significance is 3.84.
Homogeneity assumption (null hypothesis) accepted.

$i = 1, \ldots k)$ showed an overwhelming rejection of the null hypothesis; while the test for homogeneity of degree zero in prices ($\sum \gamma_{ij} = 0$) resulted in an acceptance of the homogeneity assumption. We turn to the discussion of the elasticities compued from the estimated parameters.

6.1.2 Elasticity Estimates

Tables 23 to 26 present the complete price and food expenditure elasticity matrices for Luzon, Visayas, Mindanao, and the Philippines while Table 27 presents the elasticity decompositions. We first describe the procedures for estimating the elasticities, then proceed to discuss the results.

First, we obtained an estimate of the expected value of the dependent variable E(Y) for each of the five occupational groups using:

$$(6.2) \quad E(Y) = ZF(Z) + \sigma f(Z)$$

where $Z = XB/\sigma$, F( ) is the normal cumulative distribution function and f( ) is the unit normal density. Then estimates of the total elasticity (e_{ij}) and its components: (1) the participation elasticity (e_{ij}^P), which is the elasticity of the <u>probability</u> of consumption with respect to X_i, and (2) the nonlimit consumption elasticity (e_{ij}^N) were computed for each of the five occupational groups using the following formulae (from Thraen, Hammond, and Buxton, 1978):

Table 23. Total response elasticities for Luzon.

	Food Expenditure - - Compensated Price Elasticities																
	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Root and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.	Q17 Expenditure Elasticity
Rice	-0.17	-0.09	0.41	0.47	0.00	-0.11	0.06	-0.07	0.42	-0.08	0.09	0.04	0.04	-0.03	0.00	-0.11	5.08
Corn	0.00	-0.21	-0.44	-0.12	-0.03	0.10	-0.52	-0.68	-1.04	-1.72	-0.24	-0.33	-0.33	-0.01	-0.01	-0.17	-2.43
Rice & Corn Products	0.04	0.10	-7.45	0.40	0.32	0.94	-0.10	0.37	-1.51	0.07	-0.16	-0.36	-0.36	0.11	-0.04	0.71	4.26
Other Cereal Products	0.12	0.04	-0.44	-4.63	0.19	0.31	0.22	0.61	-0.04	0.21	0.36	-0.05	-0.05	0.13	0.07	0.87	4.41
Starchy Roots & Tubers	-0.12	0.25	0.03	0.11	-0.54	0.17	0.03	0.39	-0.34	-0.27	0.76	0.26	0.26	0.01	0.05	-0.45	4.21
Sugars & Syrups	0.04	0.06	-0.33	0.15	0.04	-0.34	n.s.	0.47	0.36	0.29	-0.01	-0.10	-0.10	0.04	0.04	0.84	6.41
Fats & Oils	0.10	0.03	-0.06	-0.86	0.05	0.18	-1.97	0.58	0.17	-0.47	0.36	0.08	0.08	0.07	0.05	0.43	4.57
Fish	-0.12	0.02	-0.20	-0.21	0.08	0.03	0.20	-1.15	0.94	0.75	0.14	0.03	0.03	0.05	0.07	0.23	8.37
Meat	0.12	0.05	0.17	0.23	0.25	0.25	0.12	0.62	-4.14	0.12	0.41	-0.39	-0.39	0.20	0.00	1.11	4.80
Poultry	0.10	0.10	-0.19	0.22	0.39	0.39	-0.06	0.71	-1.05	-7.92	-0.39	-0.23	-0.23	0.20	0.00	1.05	-0.02
Eggs	0.02	-0.11	-0.04	0.06	0.18	0.31	0.12	1.20	0.60	-1.05	-0.40	-0.19	-0.19	0.12	-0.08	0.64	5.68
Dairy	0.08	0.08	-0.02	-0.20	0.11	0.35	-0.03	0.51	-0.19	-1.97	-3.00	-0.30	-0.30	0.10	0.02	0.64	3.36
Dried Beans,Nuts & Seeds	0.07	-0.05	0.35	0.08	0.30	0.04	-0.38	0.52	0.42	0.03	-0.16	-2.27	-2.27	0.24	-0.07	0.36	2.19
Vegetables	-0.22	-0.06	0.14	0.49	-0.04	0.03	0.26	0.36	0.62	0.48	0.41	0.08	0.08	-0.32	0.02	0.33	9.71
Fruits	0.08	0.08	0.37	-0.40	0.17	0.04	-0.04	0.50	0.01	0.19	-0.37	0.02	0.02	0.06	-0.44	0.46	9.52
Miscellaneous	0.23	0.06	-0.08	-0.08	0.09	0.13	-0.12	0.05	0.09	-1.18	-0.16	-0.04	-0.04	0.07	0.04	-0.91	5.49

Table 24. Total response elasticities for Visayas.

	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Root and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.	Q17 Expenditure Elasticity
	Food Expenditure - Compensated Price Elasticities																
Rice	-0.34	0.00	-0.50	0.52	0.03	0.10	0.08	0.28	-0.17	1.40	1.32	-0.06	-0.94	-0.02	0.04	0.06	5.88
Corn	0.44	-0.17	0.64	-0.34	-0.16	-0.34	-0.36	-0.61	0.76	-2.72	-0.63	0.78	0.39	-0.03	-0.09	-0.63	-2.87
Rice & Corn Products	0.01	-0.12	-3.15	-0.24	0.12	0.26	-0.26	0.16	-1.41	-1.08	-1.04	0.89	0.18	0.05	0.04	0.10	0.74
Other Cereal Products	0.00	-0.09	1.05	-6.00	0.09	0.53	0.80	0.76	0.12	-0.96	-0.93	-1.45	-0.81	0.28	0.02	0.80	6.23
Starchy Roots & Tubers	-0.01	0.23	0.21	-0.19	-0.29	-0.25	-0.80	-0.04	-0.57	0.32	-0.40	0.26	-0.08	-0.01	0.02	-0.20	2.19
Sugars & Syrups	0.04	-0.06	0.45	-0.09	0.08	-0.62	-0.27	0.68	-0.07	-0.31	-1.30	0.45	-0.26	0.11	n.s.	0.69	7.92
Fats & Oils	-0.09	0.06	0.85	-1.31	0.02	-0.13	-2.60	0.70	0.32	-0.43	-3.26	0.40	-0.59	0.09	0.02	0.35	6.78
Fish	-0.15	-0.03	-0.16	0.24	0.05	0.03	0.01	-1.28	0.93	-0.04	0.19	1.32	-0.03	0.08	0.03	0.10	8.32
Meat	0.13	-0.05	0.33	-0.30	0.13	0.52	0.49	0.45	-5.70	-1.63	1.51	-0.56	-1.13	0.24	0.04	0.69	2.85
Poultry	-0.01	0.09	-0.21	0.42	0.12	0.05	-0.46	0.31	-0.96	-4.46	-1.81	0.04	-0.31	0.07	0.02	0.47	-1.93
Eggs	-0.07	-0.05	0.71	-0.12	0.11	0.21	-0.10	1.42	-1.72	-1.44	-6.01	-0.75	-1.20	0.26	0.00	0.87	7.26
Dairy	-0.03	-0.05	0.19	-0.11	0.11	0.29	0.51	0.00	-0.19	-0.63	-1.17	-4.63	-0.29	0.10	0.01	0.56	2.16
Dried Beans,Nuts & Seeds	-0.31	-0.09	0.21	0.25	0.08	0.28	0.69	1.14	-0.08	-3.68	-1.16	0.45	-3.08	0.06	-0.01	0.39	5.59
Vegetables	-0.17	-0.05	0.16	0.61	0.02	0.02	-0.02	0.51	0.43	0.47	-0.69	0.33	-0.16	-0.33	0.00	0.12	8.61
Fruits	-0.05	-0.01	0.19	-0.05	0.05	0.01	0.13	0.56	0.16	0.35	0.78	-0.43	0.24	0.07	-0.18	0.21	10.80
Miscellaneous	0.13	-0.25	0.28	-0.04	0.09	0.05	0.46	0.21	-1.32	1.99	0.95	0.06	-0.26	0.04	-0.02	-0.63	8.34

Table 25. Total response elasticities for Mindanao.

	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Root and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.	Q17 Expenditure Elasticity
					Food Expenditure - Compensated Price Elasticities												
Rice	-0.77	-0.13	-0.58	0.99	0.00	-0.05	-0.05	0.26	-0.06	-0.41	0.45	1.23	0.00	0.08	0.02	-0.01	5.09
Corn	0.71	0.05	1.37	-0.59	0.06	-0.05	-0.17	-0.11	0.46	0.30	1.89	-1.44	0.00	-0.13	-0.03	-0.50	-0.43
Rice & Corn Products	-0.03	0.08	-3.65	-0.40	0.13	0.23	-0.29	0.02	0.12	-1.61	-0.79	-2.30	-0.22	0.29	0.02	0.80	1.50
Other Cereal Products	0.19	-0.12	-0.13	-7.33	0.09	0.98	0.02	1.66	-1.38	1.10	-3.45	-0.55	-0.61	0.28	0.03	0.75	4.61
Starchy Roots & Tubers	0.08	0.07	-0.22	-0.50	-0.48	0.06	-0.56	-0.02	0.78	-1.07	0.33	-1.24	-0.01	-0.01	n.s.	-0.38	5.07
Sugars & Syrups	0.04	-0.16	-0.22	-0.68	0.01	-0.29	-0.12	0.71	0.04	0.08	-1.08	-1.45	-0.02	0.15	0.02	0.92	5.75
Fats & Oils	-0.09	-0.21	0.29	-1.84	0.05	0.07	-2.06	0.71	-0.67	-2.54	-2.23	1.22	-0.34	0.03	0.00	0.80	6.63
Fish	-0.05	-0.10	-0.07	-0.22	0.02	-0.03	0.48	-1.45	-0.02	-0.80	-1.97	0.93	0.40	0.19	0.01	0.05	7.79
Meat	0.06	0.00	-0.10	0.36	0.04	0.10	0.08	0.22	-2.01	-0.06	1.46	0.13	-0.29	0.04	0.00	0.29	1.28
Poultry	0.05	-0.04	0.25	-0.86	0.03	0.09	-0.14	-1.01	-1.14	-3.98	-0.54	-0.58	-0.49	0.01	-0.01	0.07	-2.34
Eggs	-0.15	0.02	-0.91	-1.21	-0.04	0.29	-0.74	1.10	-1.73	-0.16	-8.02	0.80	-0.03	0.36	0.01	0.74	4.19
Dairy	-0.07	0.14	-0.37	-0.47	0.05	0.20	0.10	0.60	-0.73	0.45	-1.68	-0.90	0.24	0.13	0.00	0.67	2.49
Dried Beans,Nuts & Seed	-0.11	0.13	0.76	-1.98	0.10	0.16	-0.69	1.07	-1.06	-0.50	-2.70	-1.99	-2.64	0.25	-0.01	0.45	4.53
Vegetables	-0.04	0.05	-0.09	-0.27	0.03	0.20	-0.16	0.85	0.93	0.83	1.81	0.10	0.04	-0.40	0.00	0.29	9.07
Fruits	-0.18	0.03	-0.40	-0.40	0.06	-0.18	0.34	0.70	-0.32	-0.01	-3.21	1.45	0.22	-0.05	-0.09	0.28	10.08
Miscellaneous	-0.16	-0.15	0.50	-0.24	-0.03	0.68	0.34	-0.09	0.52	0.22	-1.59	-0.83	-0.46	0.11	-0.01	-0.07	7.35

Table 26. Total response elasticities for the Philippines

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish	Q9 Meat
Rice	-0.34	-0.08	0.00	0.60	0.00	-0.06	0.04	0.06	0.19
Corn	0.51	-0.08	0.84	-0.42	-0.07	-0.19	-0.30	-0.42	0.49
Rice & Corn Products	0.02	0.04	-5.60	0.07	0.23	0.62	-0.18	0.24	-1.12
Other Cereal Products	0.11	0.00	-0.18	-5.15	0.16	0.42	0.28	0.76	-0.17
Starchy Roots & Tuber	-0.03	0.18	-0.02	-0.16	-0.47	0.05	-0.33	0.17	0.02
Sugars & Syrups	0.04	0.00	-0.17	-0.03	0.04	-0.38	--	0.55	0.23
Fats & Oils	0.04	-0.01	0.12	-1.08	0.05	0.12	-2.07	0.62	0.05
Fish	-0.11	-0.02	-0.16	-0.09	0.05	0.02	0.21	-1.25	0.72
Meat	0.11	0.03	0.14	0.19	0.19	0.26	0.16	0.52	-3.93
Poultry	0.07	0.07	-0.13	0.09	0.29	0.29	-0.15	0.37	-1.04
Eggs	-0.02	-0.08	-0.06	-0.17	0.13	0.29	-0.05	1.22	-0.14
Dairy	0.04	0.07	-0.04	-0.22	0.11	0.32	0.07	0.44	-0.26
Dried Beans, Nuts, and Seeds	-0.04	-0.03	0.39	-0.21	0.10	0.11	-0.20	0.74	0.08
Vegetables	0.10	-0.04	0.10	0.36	-0.01	0.06	0.13	0.48	0.64
Fruits	0.00	0.05	0.18	-0.32	0.12	-0.01	0.07	0.55	-0.02
Miscellaneous	0.09	-0.10	0.20	-0.11	0.06	0.26	0.27	0.06	-0.23

Table 26. Total response elasticities for the Philippines. (cont'd)

INDEPENDENT VARIABLES	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.	Real Food Exp. Elast
Rice	0.15	0.42	0.29	0.02	0.00	0.01	-0.06	5.25
Corn	-1.45	0.39	-0.19	0.18	-0.07	-0.06	-0.54	-1.87
Rice & Corn Products	-0.58	-0.64	-0.51	-0.21	0.14	-0.01	0.59	2.82
Other Cereal Products	0.14	-0.28	-0.31	-0.23	0.17	0.06	0.85	4.70
Starchy Roots & Tuber	-0.44	0.39	-0.28	0.10	0.00	n.s.	-0.38	4.15
Sugars & Syrups	0.14	-0.43	-0.23	-0.12	0.07	n.s.	0.83	6.57
Fats & Oils	-0.81	-0.55	0.31	-0.08	0.06	0.04	0.48	5.20
Fish	0.19	-0.33	0.57	0.10	0.09	0.05	0.15	8.22
Meat	-0.15	0.76	-0.31	-0.47	0.18	0.01	0.89	3.86
Poultry	-6.69	-0.67	-0.24	-0.29	0.15	0.01	0.79	-0.72
Eggs	-0.97	-2.48	-0.11	-0.32	0.18	-0.05	0.70	5.70
Dairy	-1.44	-2.55	-1.03	-0.22	0.10	0.01	0.63	3.06
Dried Beans, Nuts, and Seeds	-0.85	-0.77	-1.64	-2.50	0.20	-0.05	0.38	3.29
Vegetables	0.55	0.48	0.13	0.03	-0.34	0.01	0.28	9.39
Fruits	0.19	-0.65	0.20	0.11	0.04	-0.31	0.37	9.93
Miscellaneous	0.22	-0.22	-0.23	-0.23	0.07	0.01	-0.58	6.92

Table 27. Decomposition of own-price and food expenditure elasticities, by island group.

	Luzon					
	Compensated Own-Price Elasticities			Real Food Expenditure Elasticities		
	e_{ii}	e^P_{ii}	e^N_{ii}	E_i	E^P_i	E^N_i
Rice	-0.168	-0.008	-0.160	5.080	0.069	5.011
Corn	-0.205	-0.208	0.003	-2.433	-0.648	-1.785
Rice and Corn Prodts.	-7.452	-2.872	-4.578	4.261	1.044	3.217
Other Cereal Products	-4.633	-1.154	-3.480	4.409	0.749	3.660
Starchy Roots and Tubers	-0.544	-0.480	-0.064	4.207	0.981	3.225
Sugars and Syrups	-0.339	-0.101	-0.238	6.406	0.831	5.575
Fats and Oils	-1.970	-0.568	-1.402	4.566	0.741	3.825
Fish	-1.151	-0.204	-0.946	8.369	0.885	7.484
Meat	-4.140	-1.050	-3.090	4.796	0.963	3.833
Poultry	-7.918	-2.531	-5.388	-0.018	-0.005	-0.014
Eggs	-6.534	-1.737	-4.796	5.679	1.159	4.520
Dairy	-2.996	-0.775	-2.221	3.358	0.684	2.674
Dried Beans, Nuts and Seeds	-2.265	-0.852	-1.413	2.187	0.467	1.719
Vegetables	-0.323	-0.100	-0.223	9.714	0.741	8.973
Fruits	-0.443	-0.262	-0.181	9.523	1.464	8.060
Miscellaneous	-0.907	-0.225	-0.682	5.493	0.920	4.573

Table 27. Decomposition of own-price and food expenditure elasticities, by island group.

	Visayas					
	Compensated Own-Price Elasticities			Real	Food Expenditure Elasticities	
	e_{ii}	e^{P}_{ii}	e^{N}_{ii}	E_i	E^{P}_i	E^{N}_i
Rice	-0.336	-0.050	-0.286	5.878	0.252	5.626
Corn	-0.165	-0.170	0.004	-2.868	-0.704	-2.164
Rice and Corn Prodts.	-3.149	-1.395	-1.754	0.739	0.187	0.552
Other Cereal Products	-5.995	-1.814	-4.180	6.231	1.302	4.929
Starchy Roots and Tubers	-0.288	-0.359	0.070	2.191	0.540	1.651
Sugars and Syrups	-0.617	-0.234	-0.383	7.920	1.315	6.605
Fats and Oils	-2.603	-0.802	-1.801	6.776	1.216	5.560
Fish	-1.276	-0.178	-1.098	8.317	0.629	7.688
Meat	-5.701	-1.635	-4.066	2.854	0.662	2.192
Poultry	-4.461	-1.435	-3.026	-1.934	-0.507	-1.427
Eggs	-6.011	-1.731	-4.280	7.263	1.602	5.661
Dairy	-4.631	-1.260	-3.371	2.163	0.399	1.676
Dried Beans, Nuts and Seeds	-3.084	-1.182	-1.902	5.591	1.278	4.313
Vegetables	-0.329	-0.119	-0.210	8.612	0.797	7.816
Fruits	-0.175	-0.221	0.046	10.797	2.117	8.681
Miscellaneous	-0.625	-0.236	-0.389	8.338	1.414	6.924

Table 27. Decomposition of own-price and food expenditure elasticities, by island group.

	Mindanao					
	Compensated Own-Price Elasticities			Real Food Expenditure Elasticities		
	e_{ii}	e^{P}_{ii}	e^{N}_{ii}	E_i	E^{P}_i	E^{N}_i
Rice	-0.768	-0.190	-0.578	5.092	0.395	4.698
Corn	0.049	0.050	-0.002	-0.425	-0.096	-0.328
Rice and Corn Prodts.	-3.646	-1.576	-2.070	1.502	0.391	1.111
Other Cereal Products	-7.330	-2.120	-5.213	4.614	0.999	3.616
Starchy Roots and Tubers	-0.477	-0.517	0.040	5.073	1.263	3.810
Sugars and Syrups	-0.291	-0.111	-0.180	5.753	0.995	4.758
Fats and Oils	-2.060	-0.652	-1.408	6.632	1.242	5.390
Fish	-1.446	-0.249	-1.197	7.788	0.825	6.963
Meat	-2.012	-0.098	-1.914	1.276	0.051	1.225
Poultry	-3.977	-1.312	-2.665	-2.337	-0.630	-1.707
Eggs	-8.020	-2.014	-6.006	4.186	0.840	3.347
Dairy	-0.904	-0.204	-0.700	2.490	0.491	1.999
Dried Beans, Nuts and Seeds	-2.639	-0.994	-1.645	4.529	-0.133	3.487
Vegetables	-0.399	-0.133	-0.266	9.069	0.915	8.154
Fruits	-0.093	-0.164	0.072	10.075	1.979	6.096
Miscellaneous	-0.651	-0.248	-0.402	7.346	1.348	5.999

$$(6.3)\quad e_{ij} = \frac{\partial y}{\partial x} \quad \frac{x}{y} \quad \text{where} \quad \frac{\partial y}{\partial x} = X\hat{\beta}F(Z) \quad \frac{x}{y}$$

and $y = E(Y)$, $XB = X\hat{\beta}$ is an index of consumption estimated by mmultiplying the vector X (evaluated at the mean) and the estimated parameters.

The participation elasticity was computed as:

$$(6.4)\quad e_{ij}^{P} = \frac{X\hat{\beta}}{\hat{\sigma}} \; \frac{f(Z)}{F(z)}$$

and the nonlimit consumption elasticity e_{ij}^{N} (or the quantity elasticity, participation probability held constant) computed as:

$$(6.5)\quad e_{ij}^{N} = e_{ij} - e_{ij}^{P}$$

To facilitate interpretation of results, the five sets of estimates for each island group were aggregated using consumption weights to obtain island-group specific elasticities group, using the formula:

$$(6.6)\quad e_{ij}^{G} = \sum_{m=1}^{5} \frac{n(m)\cdot Q(m)\cdot e_{ij}(m)}{\sum_{m=1}^{5} n(m)\cdot Q(m)}$$

Differences in consumption behavior and in price-responsiveness exist across the three island groups, and we shall discuss this extensively with respect to the main food energy sources--rice, corn, rice and corn products, other cereals and starchy roots.

Examining the elasticity coefficients for rice, we note that the e_{ii}'s are smaller (in absolute value) in Luzon than in Visayas and Mindanao, while the price elasticity for corn is larger in Luzon than in Visayas, for which both are negative. The e_{ii} for corn in Mindanao is however, positive. This can be explained by the dominance of rice as a staple food in Luzon; thus demand for rice would tend to be more inelastic as compared with that in corn-consuming regions such as the Visayas and Mindanao. Rice tends to be viewed as a superior substitute to corn, especially in Mindanao, where the rice price elasticity is large and the corn price elasticity positive (since it is an inferior staple and a Giffen good).

The differences in cereal consumption behavior are more obvious when we examine the components of the total response coefficient (Table 28). As mentioned above, the total response coefficient is the sum of the participation elasticity and the nonlimit consumption elasticity (also called the market response elasticity). The relative share of each component is indicated in Table 29.

We see that in the case of rice, the participation elasticity accounts for only 4.8% of the total response in Luzon, 14.9% of the total in the Visayas, and a high 24.7% of the total in Mindanao. This means that the effect of prices on the

Table 28. Relative Sizes of Participation and Market Response Elasticities (in percent).

	Luzon				Visayas				Mindanao			
	Own-Price		Food Expenditure		Own-Price		Food Expenditure		Own-Price		Food Expenditure	
	e^P_{ii}	e^M_{ii}	E^P_i	E^M_i	e^P_{ii}	e^M_{ii}	E^P_i	E^M_i	e^P_{ii}	e^M_{ii}	E^P_i	E^M_i
Rice	4.8	95.2	1.4	98.6	14.9	85.1	4.3	95.7	24.7	75.3	7.8	92.2
Corn	*	*	26.6	73.4	*	*	24.5	75.5	*	*	22.6	77.4
Rice and Corn Prodts.	38.5	61.4	24.5	75.5	44.3	55.7	25.3	74.7	43.2	56.6	26.0	74.0
Other Cereal Products	24.9	75.1	17.0	83.0	30.3	69.7	20.9	79.1	28.9	71.1	21.7	78.3
Starchy Roots and Tubers	88.2	11.8	23.3	76.7	*	*	24.6	75.4	*	*	24.9	75.1
Sugars and Syrups	29.8	70.2	13.0	87.0	37.9	62.1	16.6	83.4	38.1	61.9	17.3	82.7
Fats and Oils	28.8	71.2	16.2	83.8	30.8	69.2	17.9	82.1	31.7	68.3	18.7	81.3
Fish	17.7	82.2	10.6	89.4	13.9	86.1	7.6	92.4	17.2	82.8	10.6	89.4
Meat	25.4	74.6	20.1	79.9	28.7	71.3	23.2	76.8	4.9	95.1	4.0	96.0
Poultry	32.0	68.0	27.8	72.2	32.2	67.8	26.2	73.8	33.0	67.0	27.0	73.0
Eggs	26.6	73.4	20.4	79.6	28.8	71.2	22.1	77.9	25.1	74.9	20.1	79.9
Dairy	25.9	74.1	20.4	79.6	27.2	72.8	18.4	81.6	22.6	77.4	19.7	80.3
Dried Beans, Nuts and Seeds	37.6	62.4	21.4	78.6	38.3	61.7	22.9	77.1	37.7	62.3	*	*
Vegetables	31.0	69.0	7.6	92.4	36.2	63.8	9.3	90.7	33.3	66.7	10.1	89.9
Fruits	59.1	40.9	15.4	84.6	*	*	19.6	80.4	*	*	19.6	80.4
Miscellaneous	24.8	75.2	16.7	83.3	37.8	62.2	17.0	83.0	38.1	61.9	18.4	81.6

Table 29. Uncompensated price elasticity matrix, Philippines

INDEPENDENT VARIABLES	01 Rice	02 Corn	03 Rice & Corn Products	04 Other Cereal Products	05 Starchy Roots and Tubers	06 Sugars & Syrups	07 Fats & Oils	08 Fish
Rice	-1.194	-0.186	-0.070	0.371	-0.140	-0.171	-0.063	-0.877
Corn	0.836	-0.001	0.863	-0.353	-0.018	-0.148	-0.271	-0.047
Rice & Corn Products	-0.431	0.018	-5.632	-0.070	0.162	0.558	-0.242	-0.231
Other Cereal Products	-0.647	-0.073	-0.247	-5.370	-0.095	0.104	0.178	-0.222
Starchy Roots & Tubers	-0.744	0.095	-0.081	-0.334	-0.610	-0.035	-0.415	-0.592
Sugars & Syrups	-1.036	-0.120	-0.256	-0.332	-0.126	-0.530	-0.206	-0.602
Fats & Oils	-0.816	-0.186	0.048	-1.310	-0.093	0.003	-2.177	-0.295
Fish	-1.488	-0.204	-0.274	-0.446	-0.160	-0.163	0.048	-2.731
Meat	-0.498	-0.013	0.088	-0.005	-0.103	0.166	0.072	-0.122
Poultry	0.203	0.104	-0.116	0.113	0.313	0.300	-0.137	0.520
Eggs	-0.945	-0.175	-0.131	-0.433	-0.006	0.161	-0.169	0.391
Dairy	-0.444	0.031	-0.079	-0.370	0.031	0.249	-0.033	0.067
Dried Beans, Nuts & Seeds	-0.598	-0.122	0.341	-0.341	0.005	0.037	-0.260	0.131
Vegetables	-1.716	-0.196	-0.027	-0.068	-0.261	-0.152	-0.072	-1.158
Fruits	-1.654	-0.164	0.045	-0.593	-0.145	-0.228	-0.127	-1.222
Miscellaneous	-1.119	-0.307	-0.251	-0.374	-0.150	0.113	0.143	-1.251

Table 29. Uncompensated price-elasticity matrix, Philippines. (cont'd)

INDEPENDENT VARIABLES	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans	Q14 Vegetables	Q15 Fruits	Q16 Misc
Rice	-0.035	0.013	0.738	-0.480	-0.058	-0.481	-0.266	-0.415
Corn	0.608	-1.403	0.339	0.766	0.205	0.103	0.037	-0.389
Rice & Corn Products	-1.372	-0.654	-0.920	-0.877	-0.244	-0.117	-0.171	0.403
Other Cereal Products	-0.569	0.030	-1.560	-0.763	-0.292	-0.253	-0.209	0.530
Starchy Roots & Tubers	-0.326	-0.543	0.038	-0.646	0.048	-0.388	-0.177	-0.652
Sugars & Syrups	-0.320	-0.026	-0.996	-1.199	-0.210	-0.522	-0.332	0.380
Fats & Oils	-0.384	-0.939	-0.030	-0.304	-0.152	-0.410	-0.245	0.125
Fish	0.057	-0.016	-0.369	-0.610	-0.017	-0.661	-0.391	-0.417
Meat	-4.278	-0.251	-0.300	-0.425	-0.519	-0.167	-0.202	0.641
Poultry	-0.996	-6.678	-2.016	-0.254	-0.276	0.224	0.036	0.847
Eggs	-0.616	-1.122	-6.811	-1.172	-0.403	-0.332	-0.372	0.308
Dairy	-0.532	-1.521	-0.698	-3.464	-0.266	-0.174	-0.162	0.428
Dried Beans, Nuts & Seeds	-0.173	-0.931	-0.715	-0.791	-2.545	-0.098	-0.220	0.146
Vegetables	-0.149	0.307	0.880	-0.970	0.006	-1.191	-0.501	-0.348
Fruits	-0.821	-0.060	-1.413	-1.541	-0.025	-0.862	-0.845	-0.320
Miscellaneous	-0.747	0.052	-0.744	-1.235	-0.325	-0.571	-0.336	-1.244

decision of the consumer to purchase the good is high in Mindanao; that is, one quarter of the total response is accounted for by the high degree of responsiveness of marginal consumers. In Luzon and the Visayas, the greater proportion of the total response elasticity is due to responsiveness in quantities purchased by households which are already in the market; i.e., nonmarginal consumers.

The case of corn is a little more complicated. While the participation elasticity in Luzon is negative, the market response elasticity is positive: marginal consumers apparently decrease consumption if prices increase, but those in the market purchase more when prices increase--indicating a strong (negative) income effect in the latter case. However, the market response elasticity is small relative to the participation elasticity. The participation elasticity is also higher than the market response elasticity in both Visayas and Mindanao. In Luzon and Visayas, the corn participation elasticity is much higher than the corresponding participation elasticities for rice, but are of the same (negative) sign. This probably indicates great sensitivity of participation - response to price in the case of corn as compared to rice. This is because corn is a staple food consumed by the lower income groups, who have been shown in previous studies (e.g. Quisumbing, 1986) to be more price-responsive than higher income groups. Note, however, that the participation elasticity for corn is positive in Mindanao, which again could be indicative of the Giffen good effect

Participation elasticities also account for a larger share of the total response for commodities like starchy roots and tubers but are smaller than the market response elasticities for the more expensive energy sources (rice and corn products other cereal products) and the protein-rich foods This suggests that for the latter category of luxury foods, the degree of total price responsiveness is more directly influenced by the behavior of households who are already consuming positive amounts of the commodity In so far as previous elasticity estimates based on cell means would tend to capture the response only of nonmarginal consumers those estimates would tend to make greater errors in estimating price, elasticities of cereals and necessities than those of protein foods and more expensive energy sources since the response of marginal consumers would not be so significant for the latter category of commodities

The uncompensated elasticity matrix for the Philippine (uncompensated with respect to the food budget) is presented in Table 30 The results are comparable to previous estimates using food expenditure as the independent variable rather than income (Quisumbing 1986)

Table 30. Semi-log elasticities for Luzon, pooled 1978-1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish
Prices								
Rice	-0.19**	0.54	-0.15	0.16	-0.63	0.07	0.23*	-0.17**
Corn	-0.11**	-2.35	0.27	0.04	1.49**	0.12	0.07	0.03
Rice & Corn Products	0.09**	0.12	-3.35**	-0.05*	0.27	-0.11*	-0.01	-0.05
Other Cereal Products	0.09**	0.40	0.50	-1.12**	0.07	0.07	-0.34**	-0.05
Starchy Roots & Tubers	-0.01	0.14	0.40**	0.17**	-2.74**	0.06	0.12	0.12**
Sugars & Syrups	-0.06**	0.13	0.39**	0.14**	0.16	-0.26**	0.18*	0.02
Fats & Oils	0.02	-0.21	0.04	0.12	0.31	0.01	-1.17**	0.07*
Fish	-0.02	-0.29	0.11	0.18**	0.48	0.20	0.29**	-0.36**
Meat	0.06**	0.36	-0.16**	0.03	0.19	0.10	0.07	0.17**
Poultry	-0.01	-0.18	0.42	0.05	0.37	0.09	-0.13	0.14*
Eggs	0.13**	-0.15	0.33	-0.20*	0.52	-0.11	0.43	0.08
Dairy	0.01	0.48	0.15	0.11	0.43	0.00	0.11	0.03
Dried Beans, Nuts & Seeds	0.01	0.03	0.09	0.01	0.42	-0.04	0.06	0.01
Vegetables	-0.04**	-0.06	0.07	0.15**	-0.11	0.08*	0.19	0.08**
Fruits	0.01	0.02	0.12	0.12**	0.20	0.09*	0.12	0.12 -
Miscellaneous	-0.02**	0.07	0.21**	0.16**	-0.17*	0.20**	0.15	0.05**
Food Expenditure	0.40**	0.86	1.37**	0.59**	2.44**	1.00**	0.90	0.95**

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07.

Table 30. Semi-log elasticities for Luzon, pooled 1978-1982 data. (cont'd)

INDEPENDENT VARIABLES	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.
Prices								
Rice	0.26	0.43	0.02	0.23	0.15	-0.27 **	0.18	0.67 *
Corn	0.01	0.09	-0.17 *	0.22	-0.23	-0.09 **	0.19*	0.22
Rice & Corn Products	0.16	0.24	0.03	0.05	0.18	0.03	-0.10*	-0.15
Other Cereal Products	0.26	0.36	0.07	-0.02	0.14	0.10 **	-0.06	-0.04
Starchy Roots & Tubers	0.31**	0.69**	0.15**	0.26**	0.08**	-0.05 *	0.27 **	0.30 *
Sugars & Syrups	0.15*	0.21	0.10**	0.38 **	-0.03	0.01	0.00	0.16
Fats & Oils	0.16	0.10	0.09	0.04	-0.09 *	0.08 **	0.02	0.09
Fish	0.25**	0.44	0.30**	0.30 *	0.13 *	0.10 **	0.24**	0.03
Meat	-1.05*	0.16	0.20	0.03	0.21	0.10 *	0.06	0.04
Poultry	0.22	-3.86**	-0.02 *	-0.61 **	0.15	0.08	0.09	-0.44 *
Eggs	-0.11	-0.38	-1.57**	-0.02	0.30	0.29**	-0.34	-0.45
Dairy	0.20	0.07	0.04	-0.97 **	0.03	0.06 *	0.00	-0.06
Dried Beans, Nuts & Seeds	-0.14 *	0.04	0.02	-0.16	-0.85 **	0.03	0.06	-0.03
Vegetables	0.33 **	0.42**	0.15**	0.26 **	0.36 **	-0.51 **	0.12**	0.25 *
Fruits	0.08	0.10	-0.05*	0.07	-0.10 *	0.03	-1.01**	0.14
Miscellaneous	0.13 **	0.18**	0.15**	0.12 **	0.05 **	0.07 **	0.11**	-0.47 **
Food Expenditure	1.24 **	1.20	0.88 **	0.85 **	0.54 **	0.94 **	1.72 **	1.30 **

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07.

Real Food Expenditure Elasticities. With a few exceptions, the values of the real food expenditure elasticities are greater than one, indicating high responsiveness of food consumption to changes in real food expenditure. The corn food expenditure elasticity is negative, as expected, because it is an inferior staple. However, this elasticity is relatively small (in absolute value) for Mindanao. The unexpected result is the negative food expenditure elasticities for poultry, which is normally regarded as luxury good. This result, however, should not be taken too seriously in view of the insignificant parameter estimates for this equation.

Of greater interest is the decomposition of the real food expenditure elasticity into its participation response (E^P_i) and market response (E^N_i) components, in Table 26, expressed in percentages of the total response in Table 27. In all cases, the market response is larger than the participation response, although relative shares vary across commodities and island groups. In most cases, the size of the market response decreases as we move from Luzon to Visayas to Mindanao; i.e. the participation response becomes more important as we move from higher income to lower income regions. The notable exceptions occur in the case of corn and meat, where the highest relative market responses (77.4% and 96% of the total, respectively) are found in Mindanao. In the cases of poultry, eggs and dairy products, the market elasticity accounts for the highest share in the Visayas.

The general conclusion that can be arrived at when comparing relative sizes of the participation and market response elasticities betweeen the own-price and food expenditure elasticities is the greater importance of the participation elasticity as a component of the own-price elasticity as compared to the real food expenditure elasticity. This is probably because of the element of substitutability implicit in the price response.

6.1.3 Comparison with OLS Estimates

In contrast to the previous Philippine elasticity estimates based on ordinary least squares (OLS), this study uses the Tobit estimation procedure. At this point we compare the two sets of estimates as well as the predictive power of OLS versus Tobit estimation methods.

Comparison of Elasticity Estimates. If OLS were used to estimate equation (5.1), the basic estimating equation would be:

$$(6.7) \quad q_i = \alpha_i + \beta_i \ln m_f + \gamma_{ij} \ln P_j + \sum \theta_{ik} OCC_k + \sum_t \delta_t Year_t + u_t$$

Let $x = m_f, P_1 \ldots P_n$ for brevity. In that case (6.7) can be rewritten as

$$(6.8)\quad q_i = \alpha_i + \beta_i \ln X_i + \sum \theta_{ik} OCC_k + \sum_t \delta_t \, Year_t + u_t.$$

The equation is then a semi-logarithmic function of real food expenditure and prices plus occupational and time dummy variables. The elasticities of q_i with respect to real food expenditure or prices (x_j) can be computed as follows:

$$(6.9)\quad e_i X_j = \frac{\partial q_i}{\partial x_j} \cdot \frac{x_j}{q_i} = \frac{1}{x_j} \cdot \hat{\beta}_{ij} \cdot \frac{x_j}{q_i} = \frac{\hat{\beta}_{ij}}{q_i},$$

where $e_i x_j$ = elasticity of good i with respect to the independent variable j

$\hat{\beta}_{ij}$ = OLS regression coefficient of X_j in equation i

q_i = mean value of the dependent variable q_i

(elasticities are evaluated at the mean).

The results of the semi-log elasticity computations are presented in Tables 31 to 34. For ease of comparison, own-price elasticities and real food expenditure elasticities are presented in Tables 35 and 36.

It is immediately apparent from a comparison of the OLS and Tobit elasticities that, in general, the Tobit elasticities are larger (in absolute value) than the OLS estimates. For the price elasticities, the notable exceptions occur for rice, corn, starchy roots and tubers, vegetables and fruits (the latter two for Luzon and Mindanao only). This seems to indicate that OLS

Table 31. Semi-log elasticities for Visayas, pooled 1978-1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish
Prices								
Rice	-0.43**	1.28	0.36	-0.02	-0.07	0.10	-0.09	-0.20*
Corn	0.00	-0.60	-1.23	-0.22	1.98	-0.19	0.14	-0.06
Rice & Corn Products	-0.16**	0.41	-3.11**	0.36**	0.58	0.20	0.29*	-0.06
Other Cereal Products	0.12*	-0.16	0.07	-1.57**	-0.01	0.10	-0.32*	0.06
Starchy Roots & Tubers	0.07*	-0.53*	0.60*	0.03**	-2.20**	0.23**	-0.03	0.13*
Sugars & Syrups	0.06	-0.26	0.33	0.27**	-0.26	-0.46**	-0.06	0.02
Fats & Oils	0.03	-0.09	0.11	0.29*	-0.53	-0.07	-1.01**	0.00
Fish	0.10**	-0.34	0.30	0.32**	0.17	0.37**	0.28**	-0.50*
Meat	-0.92	0.36	-0.20	0.18	-0.02	0.09	0.16	0.17*
Poultry	0.23**	-0.84	-0.17	-0.13	0.51	-0.03	-0.05	0.00
Eggs	0.25	-0.16	-0.72	-0.06	0.02	-0.33	-0.75**	0.04
Dairy	0.00	0.23	0.80	-0.14	0.33	0.19	0.06	0.22*
Dried Beans, Nuts & Seeds	-0.01	0.30	0.48	-0.22*	0.16	-0.08	-0.14	-0.01
Vegetables	-0.04	-0.01	0.07	0.29**	0.01	0.21**	0.16**	0.14*
Fruits	0.15**	-0.52*	0.15	0.03	0.34	0.01	0.13	0.12*
Miscellaneous	0.02**	-0.22**	0.06	0.37**	-0.05	0.33**	0.19**	0.05*
Food Expenditure	0.63**	-0.43	0.98	0.95**	1.25	1.42**	0.88**	0.97**

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07.

Table 31. Semi-log elasticities for Visayas, pooled 1978-1982 data. (cont'd)

INDEPENDENT VARIABLES	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.
Prices								
Rice	0.46	0.20	-0.03	-0.05	-0.66	-0.23	-0.10	0.35
Corn	-0.33	1.27	-0.04	0.19	-0.14	-0.10	-0.04	-0.95**
Rice & Corn Products	0.26	0.12	0.19*	0.15	0.19	0.06	0.10	0.18
Other Cereal Products	0.09	1.01	0.16	0.05	0.20	0.15*	0.02	-0.01
Starchy Roots & Tubers	0.12**	0.15	0.05**	0.36**	0.04	0.05	0.13	0.50**
Sugars & Syrups	0.42*	0.02	0.18	0.30	0.25	0.02	0.00	0.05
Fats & Oils	0.45	0.16	0.09	0.36	0.37	0.00	0.11	0.27
Fish	0.25	0.85	0.55**	0.03	0.22**	0.19**	0.36*	0.13
Meat	-1.83**	0.58	-0.10*	0.10	0.10	0.08	0.12	-0.45 *
Poultry	-0.22	-3.25**	0.17	-0.06	-0.50**	0.09	0.18	0.66*
Eggs	1.30	-0.81	-1.84**	-0.29	0.03	-0.13	0.30	0.35
Dairy	-0.09	0.39	0.10	-1.36**	0.07	0.06	0.08	0.03
Dried Beans, Nuts & Seeds	-0.49*	0.34	-0.23**	-0.08	-0.91 **	-0.05	0.17	-0.15
Vegetables	0.32**	0.13	0.23**	0.19	0.01	-0.57 **	0.16	0.16
Fruits	0.16	0.27	0.05	-0.01	-0.11	0.01	-1.15**	-0.15
Miscellaneous	0.26**	0.27	0.39**	0.29**	0.24 **	0.06	0.09*	-0.66**
Food Expenditure	1.13	1.00	1.14**	0.62	0.88 **	0.98 **	1.84**	1.82**

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07.

Table 32. Semi-log elasticities for Mindanao, pooled 1978 and 1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish
Prices								
Rice	-0.77**	2.04	-0.33	0.28	0.35	0.08	-0.12	-0.05
Corn	-0.26	0.33	1.03	-0.49	0.52	-0.51	-0.64	-0.22
Rice & Corn Products	-0.15**	0.79 *	-1.94 **	-0.11	-0.12	-0.05	0.13	-0.02
Other Cereal Products	0.17*	-0.13	-0.16	-1.65 **	-0.16	-0.14	-0.43*	-0.04
Starchy Roots & Tubers	0.00	0.24	0.02	0.11	-1.86 **	0.03	0.13	0.03
Sugars & Syrups	0.02	-0.05	0.03	0.36 **	0.07	-0.14	0.06	-0.01
Fats & Oils	-0.01	-0.03	0.06	0.02	-0.15	-0.01	-0.76**	0.15 *
Fish	0.05	-0.02	0.07	0.39 **	0.08	0.26*	0.23	0.40 **
Meat	0.00	0.21	0.72	-0.19	0.66	0.08	-0.09	0.00
Poultry	-0.06	0.27	-0.48	0.29	-0.36	0.06	-0.52	-0.13
Eggs	0.07	0.96	0.33	-0.67	0.41	-0.18	-0.46	-0.32
Dairy	0.15	-0.25	-1.00	0.02	-0.37	-0.26	0.23	0.13
Dried Beans, nuts & Seeds	0.00	0.10	0.24	-0.08	0.07	0.01	-0.10	0.11
Vegetables	0.08*	-0.21	0.29	0.21**	0.19	0.11*	0.04	0.22 **
Fruits	0.13**	-0.28	-0.22	0.25*	-0.05	0.26*	0.04	0.04
Miscellaneous	-0.01	-0.22 *	0.21*	0.29**	-0.22	0.33**	0.29**	0.01
Food Expenditure	0.50**	0.12	1.14	0.85*	1.72	0.89**	0.94**	0.62 **

Table 32. Semi-log elasticities for Mindanao, pooled 1978 and 1982 data. (cont'd)

INDEPENDENT VARIABLES	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetable	Q15 Fruits	Q16 Misc.
Prices								
Rice	0.41	0.60	-0.29	-0.14	-0.18	-0.05	0.02	0.12
Corn	-0.09	-0.27	0.07	0.68	0.62	0.14	0.13	-0.51
Rice & Corn Products	0.02	0.80	-0.16*	-0.15	0.24	-0.02	-0.15	-0.22
Other Cereal Products	0.64	-0.45	-0.08	-0.08	-0.31	-0.06	0.16	-0.07
Starchy Roots & Tubers	0.33*	0.08	-0.07	0.14	0.11	0.06	0.20	-0.08
Sugars & Syrups	0.29	0.30	0.21	0.27	0.06	0.13	-0.12	0.52*
Fats & Oils	0.32	0.23	-0.15	0.11	-0.17	-0.05	0.23	0.15
Fish	0.39	-0.83	0.51	0.34	0.34*	0.29**	0.34*	-0.04
Meat	-2.05**	0.10	-0.29	-0.15	-0.15	0.20	-0.02	0.12
Poultry	0.19	-5.20	0.03	0.23	-0.12	0.17	0.05	0.05
Eggs	-1.63	0.65	-2.52**	-0.49	-0.74	0.39	-0.84	-0.40
Dairy	0.18	0.50	-0.19	-0.15	-0.49	0.17	0.38	-0.17
Dried Beans, Nuts & Seeds	-0.36	-0.04	0.00	0.20	-0.71**	0.02	0.16	-0.19
Vegetables	0.10	0.09	0.36**	0.21	0.16*	-0.57	-0.07	0.19
Fruits	0.22	-0.07	0.06	0.02	-0.07	-0.65	-1.27**	-0.14
Miscellaneous	0.38**	0.23	0.26**	0.38**	0.07*	0.12**	0.14*	-0.45**
Food Expenditure	1.31	-0.15	0.77*	0.65	0.75*	1.21**	1.78**	1.16**

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07

Table 33. Semi-log elasticities for Philippines, pooled 1978-1982 data.

INDEPENDENT VARIABLES	Q1 Rice	Q2 Corn	Q3 Rice & Corn Products	Q4 Other Cereal Products	Q5 Starchy Roots and Tubers	Q6 Sugars & Syrups	Q7 Fats & Oils	Q8 Fish
Prices								
Rice	-0.37**	2.22	-0.08	0.17	-0.51	0.08	0.18*	-0.15**
Corn	-0.09**	-0.89	0.24	0.05	1.33**	0.05	0.13	-0.02
Rice & Corn Products	-0.01	0.52	-2.84**	0.03	0.40	-0.01	0.09	-0.08**
Other Cereal Products	0.12**	-0.09	0.27	-1.26**	0.08	0.04	-0.37**	-0.02
Starchy Roots & Tubers	0.02**	-0.31*	0.35**	0.14**	-2.45**	0.09**	0.10**	0.10**
Sugars & Syrups	-0.02	-0.21	0.33**	0.16**	0.09**	-0.31	0.13	0.02
Fats & Oils	0.02	-0.13	0.04	0.12*	0.18	0.00	-1.12**	0.07**
Fish	0.02	-0.30	0.20	0.22**	0.46	0.23**	0.30**	-0.47**
Meat	0.04*	0.33	-0.07**	0.03	0.17	0.10	0.07	0.15**
Poultry	0.06*	-0.54	0.10	0.00	0.23	0.04	-0.17*	0.10*
Eggs	0.20**	-0.27	0.18	-0.25**	0.66	-0.21*	0.29	-0.05
Dairy	0.00	0.33	0.10	0.09	0.36	0.03	0.11	0.10**
Dried Beans, Nuts & Seeds	0.01	0.21	0.10	-0.03	0.31	-0.03	0.02	0.03
Vegetables	-0.03**	0.03	0.12**	0.18**	-0.07	0.11**	0.18**	0.14**
Fruits	0.09**	-0.86**	0.04	0.13**	0.25	0.09**	0.14**	0.07**
Miscellaneous	0.00	-0.37**	0.23**	0.21**	-0.12	0.23**	0.17**	0.07**
Food Expenditure	0.54**	-0.61*	1.27**	0.68**	2.25**	1.07**	0.90**	0.97**

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07.

Table 33. Semi-log elasticities for Philippines, pooled 1978-1982 data. (cont'd)

INDEPENDENT VARIABLES	Q9 Meat	Q10 Poultry	Q11 Eggs	Q12 Dairy	Q13 Dried Beans Nuts, Seeds	Q14 Vegetables	Q15 Fruits	Q16 Misc.
Prices								
Rice	0.46	0.20	-0.03	-0.05	-0.66	-0.23**	-0.10	0.35**
Corn	-0.33	1.27	-0.04*	-0.19	-0.14	-0.10*	-0.04**	-0.95
Rice & Corn Products	0.26	0.12	0.19	0.15	0.19*	0.06**	0.10	0.18
Other Cereal Products	0.09	1.01	0.16	0.05	0.20	0.15**	0.02*	-0.01
Starchy Roots & Tubers	0.12**	0.15 **	0.05**	0.36**	0.04**	0.05	0.13**	0.50**
Sugars & Syrups	0.42**	-0.02 **	0.18**	0.30**	0.25	0.02	0.00	0.05
Fats & Oils	0.45	0.16	0.09	0.36*	0.37	0.08	0.11	0.27
Fish	0.25**	0.85	0.55**	0.03**	0.22**	0.19*	0.36**	0.13
Meat	-1.83**	0.58 *	-0.10	0.10	0.10	0.08**	0.12	-0.45
Poultry	-0.22	-3.25 **	0.17**	-0.06**	-0.50	0.09	0.18	0.66
Eggs	1.30	-0.81	-1.84	-0.29**	0.03	-0.13**	0.30*	0.35
Dairy	-0.09	0.39	0.10	-1.36**	0.07	0.06	-0.08	0.03
Dried Beans, Nuts & Seeds	-0.49**	0.34	-0.23	-0.08	-0.91**	-0.05	0.17	-0.15
Vegetables	0.32**	0.13 **	0.23**	0.19**	0.01**	-0.57**	0.16**	0.16**
Fruits	0.16	0.27	0.05	-0.01	-0.11*	0.01**	-1.15**	-0.15
Miscellaneous	0.26	0.27	0.39**	0.29**	0.24**	0.06**	0.09**	-0.66**
Food Expenditure	1.13	1.00	1.14**	0.62**	0.88**	0.98**	1.84**	1.82**

** Indicates significance at alpha= 0.01, critical t at 22df is 2.82.
* Indicates significance at alpha= 0.05, critical t at 22df is 2.07.

Table 34. Comparison of own-price elasticities, OLS and Tobit.

	Luzon		Visayas		Mindanao	
	OLS	Tobit	OLS	Tobit	OLS	Tobit
Rice	-0.19	-0.17	-0.43	-0.34	-0.77	-0.77
Corn	-2.35	-0.21	-0.60	-0.17	0.33	0.05
Rice and corn products	-3.33	-7.45	-3.11	-3.15	-1.94	-3.65
Other cereal products	-1.12	-4.63	-1.57	-6.00	-1.63	-7.33
Starchy roots and tubers	-2.74	-0.54	-2.20	-0.29	-1.86	-0.48
Sugars and syrups	-0.26	-0.34	-0.46	-0.62	-0.14	-0.29
Fats and oils	-1.17	-1.97	-1.01	-2.60	-0.76	-2.06
Fish	-0.36	-1.15	-0.50	-1.28	-0.40	-1.45
Meat	-1.05	-4.14	-1.83	-5.70	-2.05	-2.01
Poultry	-3.86	-7.92	-3.25	-4.46	-5.20	-3.98
Eggs	-1.57	-6.53	-1.84	-6.01	-2.52	-8.02
Dairy	-0.97	-3.00	-1.36	-4.63	-0.15	-0.90
Dried beans,nuts & seeds	-0.85	-2.27	-0.91	-3.08	-0.71	-2.64
Vegetables	-0.51	-0.32	-0.57	-0.33	-0.57	-0.40
Fruits	-1.01	-0.44	-1.15	-0.18	-1.27	-0.09
Miscellaneous	-0.47	-0.91	-0.66	-0.63	-0.45	-0.65

Table 35 Comparison of Real Food Expenditure Elasticities, OLS and Tobit.

	Luzon		Visayas		Mindanao	
	OLS	Tobit	OLS	Tobit	OLS	Tobit
Rice	0.46	5.08	0.63	5.88	0.50	5.09
Corn	0.86	-2.43	-0.43	-2.87	0.12	-0.43
Rice and corn products	1.37	-4.26	0.96	0.74	1.14	1.50
Other cereal products	0.59	4.41	0.95	6.23	0.85	4.61
Starchy roots and tubers	2.44	4.21	1.25	2.19	1.72	5.07
Sugars and syrups	1.00	6.41	1.42	7.92	0.89	5.75
Fats and oils	0.90	4.57	0.88	6.78	0.94	6.63
Fish	0.95	8.37	0.97	8.32	0.82	7.79
Meat	1.24	4.78	1.13	2.85	1.31	1.28
Poultry	1.20	-0.02	1.00	-1.93	-0.15	2.34
Eggs	0.88	5.68	1.14	7.26	0.77	4.19
Dairy	0.85	3.36	0.62	2.16	0.65	2.49
Dried beans,nuts & seeds	0.54	2.19	0.88	5.59	0.75	4.53
Vegetables	0.94	9.71	0.98	8.62	1.21	9.07
Fruits	1.72	9.52	1.84	10.80	1.78	10.08
Miscellaneous	1.30	5.49	1.82	8.34	1.16	7.35

Table 36. Comparison of root of mean squared error (MSE) between OLS estimates and Tobit estimates.

COMMODITY	Luzon OLS	Luzon Tobit	Visayas OLS	Visayas Tobit	Mindanao OLS	Mindanao Tobit	PHILIPPINES OLS	PHILIPPINES Tobit
Rice	4628.52	4624.85	5450.46	5476.82	5722.32	5718.32	5178.03	5176.34
Corn	1574.60	1595.74	4442.17	4621.37	5109.54	5306.64	3382.47	3459.29
Rice and corn products	1113.74	1079.84	928.10	972.81	1201.18	1200.86	3477.15	1069.80
Other cereal products	1164.01	1159.36	1032.62	1008.25	871.85	859.52	1106.91	1093.92
Starchy roots and tubers	6777.68	6939.82	3526.19	3657.86	4962.32	4951.69	6038.62	6218.59
Sugars and syrups	1451.04	1458.03	1516.18	1512.39	990.33	991.53	1420.68	1[illegible]24.05
Fats and oils	1582.41	1472.11	743.91	730.95	750.00	744.54	1356.33	1[illegible]52.83
Fish	3476.29	3468.82	3683.09	3638.34	3097.92	3078.07	3530.52	3518.28
Meat	2609.09	2671.92	17793.60	1806.96	1960.10	1968.35	2382.15	2411.37
Poultry	1366.65	1380.77	1058.77	1088.28	784.57	802.61	1252.56	1263.42
Eggs	678.77	680.81	556.23	553.41	565.39	652.30	641.09	683.68
Dairy	4140.77	4141.70	2473.11	2468.14	2232.54	2259.42	3634.41	3640.29
Dried beans,nuts & seeds	855.07	857.99	693.75	698.12	635.20	639.93	797.86	801.06
Vegetables	4095.02	4068.17	3061.64	3052.07	4089.26	4033.24	3970.99	3944.71
Fruits	5761.52	6064.01	5707.78	5832.21	4967.52	5063.95	5694.55	5593.93
Miscellaneous	2092.66	2152.67	3737.68	3817.12	1944.35	1969.92	2601.45	2677.30

estimates for necessities may tend to overestimate the size of the price response and this may in fact be a reason for the relatively large elasticities estimated in previous studies. That is, previous studies focused only on the market response, and not the total response (which is a sum of the participation elasticity and the market response elasticity). A line fitted to values corresponding to the consumption of nonmarginal households would tend to overstate the price elasticity. The food budget elasticities are also larger than their OLS counterparts and generally lie within the same range or are larger than the corresponding price elasticities. If this is so, income effects may be as important as, or even more important than, price effects, contrary to what Timmer (1981) suggests, even within the short-term.

Finally, both estimation procedures yield mixed results as far as the RMSE criterion is concerned (Table 37). That is, for some equations, the Tobit method yields smaller RMSE, while for other commodities, OLS estimated equations have lower RMSE.

We turn now to the results of the translog system applied to the NCSO FIES data.

6.2 Total Expenditure Subsystem

6.2.1 Estimation Results

The various sets of estimates of the total expenditure

Table 37. Translog regression results, quadratic form, actual prices, unconstrained estimates.

	Intercept	Log Real Expenditure	(log Real Expenditure)²	Log Prices: Food	Shelter	Clothing	Fuel, light & water	Misc.	T1	T2	T3	REG 1	REG 2
Food	1.501	-0.245	0.008	-0.192	-0.014	0.132	0.099	0.19	0.129	0.138	0.125	0.019	0.017
	(4.337)	(-2.964)	(1.361)	(-2.251)	(-0.792)	(2.665)	(4.754)	(1.123)	(0.979)	(1.275)	(2.022)	(1.501)	(1.454)
Shelter	-0.087	0.059	-0.002	0.115	-0.015	-0.055	-0.064	-0.008	-0.018	-0.027	-0.016	-0.008	-0.008
	(-0.511)	(1.447)	(-0.703)	(2.758)	(1.722)	(-2.261)	(-6.303)	(-0.932)	(-0.279)	(-0.513)	(-0.517)	(-1.303)	(-1.432)
Clothing	0.06	0.074	-0.005	0.01	-0.011	-0.003	-0.011	-0.010	-0.074	-0.064	-0.052	-0.006	0
	(-0.634)	(3.304)	(-2.650)	(-0.448)	(-2.365)	(-0.253)	(-1.978)	(-2.169)	(-2.063)	(-2.166)	(-3.132)	(-1.762)	(0.116)
Fuel, light and water	0.301	-0.077	0.005	0.009	-0.003	0.015	0.001	-0.002	0.022	0.001	0.006	-0.001	0.004
	(6.094)	(-6.511)	(5.659)	(0.748)	(-1.031)	(2.136)	(0.394)	(-0.962)	(1.180)	(0.955)	(0.642)	(-0.548)	(2.419)

Log-likelihood= 4355.66

system using the translog demand function are presented in Tables 38 to 45. For brevity, a comparison of the eight sets of estimates yields the following observations:

(1) Quadratic forms outperform linear forms and the use of index prices yields better results than actual prices (on the basis of log-likelihood).

(2) However, not all the quadratic real expenditure terms are significant: they are significant in 7 out of 8 sets for clothing (negative) and fuel, light and water (positive) and are insignificant for food and shelter.

(3) While the tests for homogeneity and symmetry lead us to reject the null hypotheses (chi-squared 10 - df = 18.31), estimation with constraints yields a greater number of coefficients which are statistically significant.

On the basis of the above, the specification with the best performance is the constrained quadratic specification using index prices (Table 41). We now analyze the results for this specification in greater detail.

With the exception of the equation for shelter, the real expenditure variable is significant. As mentioned earlier, the quadratic terms are significant for clothing and for fuel, light and water. All the own-price coefficients and 8 out of 16 cross-price coefficients are significant. All the time dummies are

Table 36. Translog regression results, quadratic form, actual prices, constrained estimates.

	Intercept	Log Real Expenditure	(log Real Expenditure)	Log Prices Food	Shelter	Clothing	Fuel, light & water	Misc.	T1	T2	T3	REG 1	REG 2
Food	1.719	-0.184	0.004	0.025	-0.028	0.014	0.013	-0.025	0.060	0.083	0.089	-0.025	0.001
	(6.096)	(-2.246)	(0.678)	(1.066)	(-3.157)	(1.029)	(2.855)	(-2.327)	(5.930)	(8.069)	(8.956)	(-2.702)	(0.122)
Shelter	-0.142	0.014	0.001	-0.028	0.213	-0.009	-0.01	0.025	-0.016	-0.027	-0.012	-0.021	-0.001
	(-1.1033)	(0.359)	(0.343)	(-3.157)	(3.088)	(-1.989)	(-4.706)	(4.747)	(-3.303)	(-5.287)	(-2.463)	(4.724)	(-0.143)
Clothing	-0.152	0.075	-0.005	0.014	-0.009	0.005	0	-0.011	-0.012	-0.013	-0.024	-0.006	0.003
	(-1.978)	(3.366)	(-2.926)	(1.029)	(-1.989)	(0.410)	(-0.115)	(-2.648)	(-4.202)	(-4.593)	(-8.716)	(-1.987)	(0.950)
Fuel, light and water	0.361	-0.077	0.005	0.013	-0.010	0	-0.003	0	-0.006	-0.008	-0.007	5.999	60.003
	(8.975)	(-6.546)	(5.726)	(2.855)	(-4.706)	(-0.115)	(-1.927)	(-0.060)	(-3.802)	(-5.447)	(-5.198)	(-0.836)	(2.019)

Chi-squared (10df) = 105.018
Critical chi-squared at 10df, alpha= 0.05 is 18.31.

Table 39. Translog regression results, quadratic form, index prices, unconstrained estimates.

	Intercept	Log Real Expenditure	(Log Real Expenditure)	Log Prices: Food	Log Prices: Shelter	Log Prices: Clothing	Log Prices: Fuel, light & Water	Misc.	T1	T2	T3	REG 1	REG 2
Food	0.368	-0.135	0.002	-0.090	-0.008	0.177	-0.084	-0.004	0.273	0.259	0.182	0.013	0.016
	(1.082)	(-4.365)	(0.598)	(-1.411)	(-0.614)	(2.643)	(5.359)	(-0.338)	(2.793)	(3.200)	(3.946)	(1.214)	(1.672)
Shelter	0.307	0.025	0	0.103	0.015	-0.114	-0.063	0.001	-0.096	-0.094	-0.051	-0.009	-0.01
	(1.445)	(1.292)	(0.178)	(2.574)	(1.796)	(-2.716)	(-6.413)	(0.174)	(-1.575)	(-1.858)	(-1.759)	(-1.333)	(-1.768)
Clothing	0.043	0.07	-0.006	-0.048	-0.015	0.043	-0.007	-0.005	-0.054	-0.048	-0.043	-0.001	0.004
	(0.354)	(6.348)	(-5.657)	(-2.100)	(-3.255)	(1.783)	(-1.209)	(-1.241)	(-1.555)	(-1.650)	(-2.585)	(-0.224)	(1.223)
Fuel, light and water	0.072	-0.037	0.003	0.009	-0.004	0.014	-0.001	0	0.017	0.01	0.002	0	0.004
	(1.092)	(-6.182)	(5.006)	(0.732)	(-1.440)	(1.047)	(-0.231)	(0.068)	(0.889)	(0.652)	(0.234)	(-0.163)	(1.942)

Log-likelihood= 4543.789

Table 40. Transiog regression results, quadratic form, index prices, constrained estimates.

	Intercept	Log Real Expenditure	(Log Real Expenditure)	Log prices: Food	Shelter	Clothing	Fuel, light & Water	Misc.	T1	T2	T3	REG 1	REG 2
Food	1.13	-0.129	0.001	0.055	-0.013	-0.031	0.014	-0.026	0.061	0.081	0.078	-0.024	-0.005
	(15.284)	(-4.195)	(0.420)	(2.222)	(-1.537)	(-1.521)	(3.064)	(-3.179)	(8.615)	(11.1255)	(11.223)	(-3.262)	(-0.718)
Shelter	0.008	0.019	0.001	-0.013	0.018	-0.017	-0.011	0.022	-0.02	5.971	-0.011	0.02	0.001
	(0.182)	(0.995)	(0.503)	(-1.537)	(2.675)	(-3.550)	(-5.086)	(4.597)	(-4.426)	(-6.387)	(-2.568)	(4.646)	(0.261)
Clothing	-0.104	0.071	-0.007	-0.031	-0.017	0.054	-0.002	-0.005	-0.011	-0.0012	-0.022	-0.001	0.006
	(-3.9211)	(6.437)	(-5.759)	(-1.521)	(-3.550)	(2.570)	(-0.471)	(-1.331)	(-4.217)	(-4.573)	(-8.896)	(-0.241)	(2.079)
Fuel, light and water	0.158	-0.038	0.003	0.014	-0.011	-0.002	-0.004	0.002	-0.007	-0.01	-0.009	0	0.003
	(10.943)	(-6.264)	(5.092)	(3.064)	(-5.086)	(-0.471)	(-2.375)	(1.000)	(-5.328)	(-7.165)	(-6.924)	(-0.228)	(2.173)

Chi-squared 10df= 96.2257
Critical chi-squared at 10df, alpha= 0.05 is 18.31.

Table 41. Translog regression results, linear form, actual prices, unconstrained estimates.

	Intercept	Log Real Expenditure	Log Prices: Food	Shelter	Clothing	Fuel, light & Water	Misc.	T1	T2	T3	REG 1	REG 2
Food	1.106 (5.838)	-0.133 (-18.101)	-1.780 (-2.251)	-1.013 (-0.792)	1.333 (2.690)	0.099 (4.756)	0.018 (1.063)	0.145 (1.102)	0.15 (1.388)	0.13 (2.112)	0.019 (1.438)	0.017 (1.534)
Shelter	0.013 (0.142)	0.03 (8.408)	0.112 (2.698)	0.014 (1.705)	-0.055 (-2.275)	-0.064 (-6.303)	-0.008 (-0.902)	-0.022 (-0.343)	-0.03 (-0.572)	-0.017 (-.564)	-0.008 (-1.272)	-0.008 (-1.475)
Clothing	0.164 (3.177)	0.01 (5.200)	-0.017 (-0.746)	-0.011 (-2.410)	-0.004 (-0.312)	-0.011 (-1.986)	-0.009 (-2.030)	-0.083 (-2.305)	-0.071 (-2.387)	-0.056 (-3.298)	-0.006 (-1.622)	0 (-0.053)
Fuel, light and water	0.067 (2.398)	-0.010 (-9.527)	0.016 (1.307)	-0.002 (-0.872)	0.016 (2.185)	0.001 (0.428)	-0.002 (-1.169)	0.032 (1.634)	0.022 (1.377)	0.009 (0.982)	-0.001 (-0.776)	0.004 (2.670)

Log-likelihood= 4336.568

Table 42. Translog regression results, linear form, constrained estimates.

	Intercept	Log Real Expenditure	Log Prices: Food	Shelter	Clothing	Fuel, light & Water	Misc.	T1	T2	T3	REG 1	REG 2
Food	1.532	-0.128	0.025	-0.028	0.012	0.015	0.024	0.059	0.082	0.067	-0.024	0.001
	(22.432)	(-17.386)	(1.066)	(-3.093)	(0.871)	(3.087)	(-2.251)	(5.881)	(8.077)	(8.997)	(-2.637)	(0.135)
Shelter	-0.187	0.028	-0.028	0.021	-0.008	-0.01	0.025	-0.017	-0.027	-0.012	0.021	-0.001
	(-5.917)	(7.988)	(3.093)	(3.059)	(-1.872)	(-4.941)	(4.735)	(-3.397)	(-5.461)	(-2.596)	(4.691)	(-0.128)
Clothing	0.062	0.01	0.012	-0.008	0.006	0	-0.011	-0.011	-0.011	-0.022	-0.006	0.003
	(2.759)	(5.002)	(0.871)	(1.872)	90.493)	(0.146)	(-2.682)	(-3.759)	(-4.057)	(-8.214)	(-1.970)	(0.867)
Fuel, light and water	0.139	-0.01	0.015	-0.01	0	-0.005	0	-0.007	-0.01	-0.009	-0.001	0.003
	(12.580)	(-9.325)	(3.087)	(-4.941)	(0.146)	-2.632)	(-0.026)	(-4.579)	(-6.488)	(-6.349)	(-0.816)	(2.206)

Chi-squared 10df= 104.278

Critical chi-squared at 10df, alpha=0.05 is 18.31.

Table 43. Translog regression results, linear form, index prices, unconstrained estimates.

	Intercept	Log Real Expenditure	Log Prices: Food	Shelter	Clothing	Fuel, light & Water	Misc.	T1	T2	T3	REG 1	REG 2
Food	3.312	-0.116	-0.087	-0.008	0.176	0.085	-0.004	0.277	0.262	0.183	0.013	0.016
	(0.953)	(-32.295)	(-1.366)	(-0.592)	(2.631)	(5.388)	(-0.347)	(2.837)	(3.238)	(3.976)	(1.201)	(1.708)
Shelter	0.297	0.028	0.104	0.015	-0.114	-0.063	0.001	-0.095	-0.093	-0.05	-0.009	-0.010
	(1.452)	(12.583)	(2.598)	(1.804)	(-2.720)	(-6.411)	(0.172)	(-1.567)	(-1.851)	(-1.753)	(-1.337)	(-1.760)
Clothing	0.234	0.008	-0.006	-0.016	0.046	-0.008	-0.005	-0.067	-0.057	-0.047	0	0.003
	(1.931)	(6.050)	(-2.497)	(-3.354)	(1.838)	(-1.410)	(-1.122)	(-1.861)	(-1.912)	(-2.754)	(-0.103)	(0.873)
Fuel, light and water	-0.019	-0.007	0.014	-0.003	0.012	0	0	0.023	0.015	0.004	-0.001	0.004
	(-0.296)	(-10.099)	(1.124)	(-1.228)	(0.920)	(-0.012)	(-0.004)	(1.163)	(0.915)	(0.451)	(-0.260)	(2.174)

Log likelihood= 4535.713

Table 44. Translog regression results, linear form, index prices, constrained estimates.

	Intercept	Log Real Expenditure	Log Prices									
			Food	Shelter	Clothing	Fuel, light & Water	Misc.	T1	T2	T3	RBG 1	RBG 2
Food	1.100 (61.65)	0.116 (-32.451)	0.062 (2.462)	-0.012 (-1.448)	-0.039 (-1.845)	0.015 (3.122)	-0.026 (-3.201)	0.061 (8.608)	0.080 (11.267)	0.077 (11.256)	-0.025 (-3.351)	-0.005 (-0.751)
Shelter	-0.014 (-1.272)	0.029 (12.853)	-0.012 (-1.448)	0.018 (2.669)	-0.017 (-3.498)	-0.011 (-5.096)	0.022 (4.578)	-0.020 (-4.457)	-0.029 (-6.494)	-0.011 (-2.666)	0.02 (4.631)	0.001 (0.285)
Clothing	0.043 (5.898)	0.008 (5.943)	-0.039 (-1.845)	-0.017 (-3.498)	0.062 (2.645)	-0.001 (-0.405)	-0.005 (-1.306)	-0.010 (-3.816)	-0.010 (3.761)	-0.020 (-7.890)	-0.001 (-0.132)	0.006 (1.828)
Fuel, light and water	0.088 (21.925)	-0.007 (-10.108)	0.015 (3.122)	-0.011 (-5.096)	-0.001 (-0.405)	-0.005 (-2.518)	-0.002 1.046	-0.008 (-5.454)	-0.011 (-7.620)	-0.010 (-7.507)	0 (-0.099)	0.004 (-2.457)

Chi-squared 10df= 97.1859
Critical chi-squared at 10df, alpha= 0.05 is 18.31.

Table 45. Compensated price, cross-price and total expenditure elasticities, by island group.
(Quadratic, index prices and constrained estimates)

Island Group	Food	Shelter	Clothing	Fuel, light & water	Miscellaneous	Real expenditure elasticity
Luzon	-0.35	0.11	0.02	0.07	0.15	0.79
Food	0.45	-0.73	-0.65	-0.04	0.37	1.22
Shelter	0.16	-0.08	-0.23	0.03	0.13	1.13
Clothing	0.86	-0.10	0.05	-1.04	0.24	0.82
Fuel, light & water	0.42	0.24	0.05	0.06	-0.77	1.44
Miscellaneous						
Visayas						
Food	-0.33	0.09	0.03	0.08	0.14	0.80
Shelter	0.45	-0.72	-0.07	-0.05	0.38	1.26
Clothing	0.21	-0.08	-0.26	0.03	0.13	1.12
Fuel, Light & water	0.86	-0.10	0.06	-1.03	0.22	0.83
Miscellaneous	0.43	0.23	0.06	0.06	-0.78	1.47
Mindanao						
Food	-0.33	0.09	0.03	0.07	0.15	0.80
Shelter	0.45	-0.72	-0.07	-0.05	0.39	1.26
Clothing	0.18	-0.10	-0.24	0.03	0.13	1.13
Fuel, light & water	0.88	-0.12	0.05	-1.04	0.23	0.82
Miscellaneous	0.44	0.22	0.05	0.06	-0.77	1.45

significant, while the REG1 (Luzon) dummy is significant for food and shelter and the REG2 (Visayas) dummy significant for clothing and for fuel, light and water. The estimators obtained from this specification were then used to compute price, cross-price, and total expenditure elasticities for each island group, evaluated at the mean of the independent variables, with values of expenditure shares predicted using the abovementioned means (Table 46).

6.2.2 Elasticities

The compensated price and cross-price elasticity matrix is presented in Table 46. All the price elasticities are negative and less than one with the exception of fuel, light, and water. The cross-price elasticities reveal substitutability relationships with the exception of shelter, which is complementary to clothing and to fuel, light and water. The demand for shelter, clothing, and miscellaneous services is elastic with respect to real expenditure, while those for food and for fuel, light and water are inelastic. The matrix of uncompensated price and cross-price elasticities for each island group is presented in Table 47, while aggregate compensated and uncompensated price and cross-price elasticity matrices are shown in Tables 48 and 49, respectively.

Table 50 presents a comparison of this study's estimates vis-a-vis previous demand studies for the Philippines (Lluch,

Table 46. Uncompensated price and cross-price elasticities by island group a

Island group	Food	Shelter	Clothing	Fuel, light & water	Miscellaneous
	Uncompensated price elasticities				
Luzon					
Food	-0.77	-0.32	-0.40	-0.35	-0.27
Shelter	0.30	-0.88	-0.20	-0.19	0.21
Clothing	0.08	-0.16	-0.30	-0.05	0.06
Fuel, light & water	0.83	-0.13	0.02	-1.07	0.21
Miscellaneous	0.08	-0.10	0.29	-0.28	-1.11
Visayas					
Food	-0.78	-0.36	-0.41	-0.37	-0.30
Shelter	0.32	-0.85	-0.20	-0.18	0.25
Clothing	0.13	-0.16	-0.36	-0.05	0.05
Fuel, light & water	0.82	-0.14	0.02	-0.07	0.19
Miscellaneous	0.10	-0.10	-0.27	-0.27	-1.11
Mindanao					
Food	-0.78	-0.36	-0.42	-0.38	-0.30
Shelter	0.32	-0.85	-0.21	-0.18	0.26
Clothing	0.11	-0.17	-0.31	-0.05	0.05
Fuel, light & water	0.85	-0.15	0.02	-1.07	0.20
Miscellaneous	0.10	-0.11	-0.28	-0.28	-1.11

a/ obtained from Table 45 using the Slutsky equation:

where eij is the uncompensated elasticity of i with respect to j,
ii is the compensated elasticity of i with respect to j (from Table 45),
Ei is the real expenditure elasticity of good i and is the budget share of good j.

Table 47. Compensated price and cross-price elasticity matrices, Philippines a/

Compensated elasticities ij	Food	Shelter	Clothing	Fuel, light & water	Miscellaneous
Food	-0.34	0.10	0.02	0.07	0.15
Shelter	0.45	-0.72	-0.06	-0.04	0.37
Clothing	0.17	-0.09	-0.24	0.03	0.13
Fuel, light & water	0.86	-0.10	0.05	-1.04	0.23
Miscellaneous	0.42	0.23	0.05	0.06	-0.76

a/ weighted average of island group elasticities in Table 45

Table 48. Uncompensated price and cross-price elasticity matrices, Philippines a

Uncompensated elasticities eij	Food	Shelter	Clothing	Fuel, light & water	Miscellaneous
Food	-0.77	-0.33	-0.41	-0.36	-0.28
Shelter	0.31	-0.87	-0.20	-0.18	0.23
clothing	0.10	-0.16	-0.31	-0.05	0.01
fuel, light & water	0.83	-0.13	0.02	-1.07	0.20
Miscellaneous	0.09	-0.10	-0.28	-0.28	-1.10

a\ weighted average of island group elasticites in Table 46

Table 49. Representative demand parameter estimates, Philippines

Source	Sample Period	Model	Commodity	Uncompendated Own-Price Elasticty	Cross-Price Elasticity with respect to food price	Income Elasticity
Lluch, Powell and Williams (1977)	1953-1965 a	Extended Linear Expenditure System, national accounts data	Food	-0.35	--	0.52 b/
			Clothing	-0.12	-.42	0.75 b/
			Housing	-0.4	-1.03	1.82 b/
			Durables	-0.25	-1.27	2.23 b/
			Personal care	-0.22	-0.98	1.72 b/
			Transport	-0.27	-1.36	2.39 b/
			Recreation	-0.19	-0.96	1.69 b/
			Open services	-0.34	-1.18	2.08 b/
Pante (1977)	1949-74	Linear Expenditure System, national accounts data	Food	-0.16	--	0.99
			Beverages and Tobacco	-0.35	--	1.12
			Durables	-0.33	--	1.10
			Miscellaneous	-0.26	--	0.96
This Study	1960-1975 c/	Translog, FIES, seemingly unrelated regressions	Food	-0.77	--	0.79 b/
			Shelter	-0.33	0.31	1.2 b/
			Clothing	-0.41	0.10	1.13 b/
			Fuel, light & water	-0.36	0.83	0.82 b/
			Miscellaneous	-0.28	0.09	1.45 b/

a/ years 1954, 1956, 1957 and 1959 omitted
b/ Total expenditure elasticity
c/ Four survey rounds: 1960, 1965, 1971 & 1975

Powell and Williams, 1977; Pante, 1977). Our results yield price elasticities which are, in general, higher than previous estimates based on time series data. This is not surprising since parameters estimated from cross-section data yield higher response parameters than those estimated from time series data. Expenditure elasticities, however, appear to lie within the range of previous estimates. Contrary to the results of Lluch,, Powell and Williams (1977), however, estimated cross-elasticities with respect to the food price are negative, indicating substitutability rather than complementarity. Such inconsistencies need to be resolved in further work on this topic.

The next chapter involves the use of the estimated parameters in simulations of nutrition policy interventions.

CHAPTER VII

NUTRITION POLICY SIMULATIONS

The previous chapter discussed two sets of elasticity estimates: (1) a total expenditure system and (2) a food subsystem, both yielding compensated price and cross-price elasticities (in real expenditure for (1) and in real food expenditure for (2)). In this chapter we utilize both sets of estimates in simulations of food market interventions with the aim of assessing their nutritional impact. We begin by providing a general description of the model for the simulations. Then we specify changes in two major policy variables--incomes and prices--and examine the nutritional impacts of income transfers and price subsidies and various methods of targetting these interventions to nutritionally at-risk groups. Finally, we attempt to evaluate these policies' effectiveness with respect to achieving nutritional goals.

7.1 The Basic Model and Modificatic...

Food policy instruments generally fall into one or a combination of three basic types: supply shifters, demand shifters, and price wedges. To analyze the nutritional effect of food policies, we use a model describing the price and quantity equilibrium displacement effects of each of the three basic types of food policy instruments, for an n commodity economy with m income strata. Given the nutrient content of the commodities, we estimate the effect of the policies on equilibrium nutrient intake. Since the model takes into account differential responses to price and income changes by different strata, we are able to estimate the distributional impact of alternative food policies. In this study; we have sixteen food commodities and fifteen strata (five occupational groups within three island groups).

7.1.1 The Basic Model

Consider the n-demand curves for the consuming population as a whole. Changes from the initial equilibrium levels of consumption of commodity i must result from either a shift in demand for that commodity or from a change in the price of either commodity or one of the other commodities. The percentage change in quantities demanded can be expressed as:

$$(7.1) \quad Eq_i = \sum_{j=1}^{n} e_{ij} E_{p_j}^{d} + \gamma_i E_y \qquad i = 1, \ldots, n$$

where E percentage change operator

e_{ij} the direct and cross-price elasticities of demand

γ_i the income elasticity of demand

y income

The effect of food stamp or nutritional educational programs can be represented by a reinterpretation of the demand shift ∂_i in $(\gamma_i E_y)$

Supply changes can be represented as

$$(7.2)\quad Eq_i = \sum_{j=1}^{n} S_{ij} E^S_{p_j} + \delta_i \qquad i = 1, \ldots, n$$

where S_{ij} are supply elasticities and δ_i is a supply shift due to some policy.

To incorporate the possibility of price subsidies, we specify the following equilibrium relationship between supply prices and demand prices:

$$(7.3)\quad Ep^S_i = Ep^d_i + E\beta_i \qquad i = 1, \ldots, n$$

where $E\beta_i$ is the size of the subsidy wedge for commodity i, measured as a percentage of initial equilibrium price.

The three sets of n equations each can be expressed in matrix form as

$$(7.4)\quad \begin{bmatrix} -H & 0 & I \\ 0 & -S & I \\ -I & I & 0 \end{bmatrix} \begin{bmatrix} EP^d \\ EP^s \\ EQ \end{bmatrix} = \begin{bmatrix} \Gamma E_y \\ \Delta \\ EB \end{bmatrix}$$

where H is an nxn matrix of demand elasticities e_{ij} ;
S is an nxn matrix of supply elasticities S_{ij} ;

P^d is an nx1 vector of demand prices p_i^d ;
P^s is an nx1 vector of supply prices p_i^s ;
Q is an nx1 vector of quantities q_i ;
Γ is an nx1 vector of income elasticities of demand γ_i;
Δ is an nx1 vector of supply shifts δ_i ; and
EB is an nx1 vector of price subsidies $E\beta_i$.

The solution to the system of equations (7.4) expresses changes in equilibrium prices and quantities as functions of the policy variables, E_y, Δ and EB:

$$(7.5)\quad \begin{bmatrix} EP^d \\ EP^s \\ EQ \end{bmatrix} = \begin{bmatrix} (S - H)^{-1} & (\Gamma Ey - \Delta - SEB) \\ (S - H)^{-1} & (\Gamma Ey - \Delta - HEB) \\ H(S - H)^{-1} & (SH^{-1}\ \Gamma Ey\ \Delta - SEB) \end{bmatrix}$$

Given these changes in the equilibrium consumption of commodities, the percentage change in the equilibrium level of nutrient consumption is .

$$(7.6)\quad EN = KEQ = KH(S - H)^{-1}\ (SH^{-1}\ \Gamma Ey - \Delta - SEB)$$

where K is a 1xn vector of K_i the fraction of initial total nutrient consumption provided by commodity i.

Equation system (7.4) can then be stratified to consider different income strata: basically, this involves specifying separate demand equations for each income group and solving for the equilibrium stratum-specific quantities. Equation (7.6) then is modified using the result of the stratum-specific change in quantities and the stratum's corresponding nutrient weights. The details of this derivation can be found in Quisumbing (1985).

7.1.2 Modifications

Because we have two sets of estimates corresponding to two systems of demand equations, a step-wise procedure is used in the simulations. There are two ways for handling the link between the total expenditure system and the food subsystem. First, the real income change can be defined exogenously. The resulting change in real food expenditure is then computed using the elasticity of food demand with respect to total expenditure obtained from the translog demand system. This value is then substituted into E_y in (7.1), where the subscript y is now taken to mean real food expenditure, and the matrix of price elasticities H pertains only to food commodities; this procedure assumes that the utility function is separable into food and nonfood categories.

The second alternative is to specify the size of the change in food expenditure and then to work backward and compute the income change required to bring about the change in food expenditure. We follow this procedure here.

In this study, the elasticity matrices used in the simulations contain only those for which the estimated tobit coefficients were significant at $\alpha = 0.05$; insignificant coefficients were replaced with zeroes

7.2 Nutrition Policy Simulations

The model discussed in Section 7.1 was used to simulate the nutritional effects of two types of policies: food budget transfers and price subsidies. The percentage changes in calorie and protein consumption were used as indicators of nutritional impact; however, we give greater emphasis to policies which increase calorie consumption. In designing nutrition policy, priority should be given to income-transfer and price subsidy policies that increase calorie consumption by calorie-deficient households, since calorie inadequacy is a more basic nutritional problem than is protein deficiency.

The price, cross-price and food expenditure elasticities estimated were used to simulate the potential impact of these policies. Since the elasticities estimated were long-run elasticities, the simulation results should be interpreted as the potential effects of the implementation of a package of policies for a period of approximately five years or longer. The results, therefore, do not represent one-time cash or income transfers or temporary price subsidies or increases.

Long-term income transfers can result from institutional changes that alter relative incomes of various groups, but not from short-term wage or tax policies. An example of a change that would effect a long term income transfer would be successful land reform. In addition, more specific, or food-linked, income transfers have actually been operative in economies such as those in Egypt and Sri Lanka, which have sizeable food subsidy and distribution programs. Also included in the category of food budget transfers are food stamp programs.

General price policies, on the other hand, have often been used to achieve conflicting objectives: high food prices to maintain agricultural producer incentives and low prices to protect poor consumers. Unless the two groups are effectively insulated by some tax-cum-subsidy policy, prices will no longer be able to perform a function of maintaining allocative efficiency. Economy-wide price intervention policies for the sake of increasing nutrient intake would then be very expensive to implement. In addition, the actual effect of such policies may be biased toward achieving one set of policies rather than the other. For example, the government has been more effective in defending price ceilings tnan price floors for rice and corn (Regalado, 1983), one indicator of uran bias in rice price policy (Mangahas, 1972).

Because of the cost of maintaining such policies and the possibility of conflicting producer and consumer objectives, it is perhaps desirable to adopt some targeting scheme, whether on particular commodities, or to specific income groups:

7.2.1 Food Budget Transfers

Food budget transfers (or food-linked income transfers) serve to increase the demand for a commodity at the prevailing price. The effect of such transfers upon nutrition depends upon relative preferences for food compared to nonfood items and the ability of supply to meet the increased demand. We consider the role of food-nonfood preferences only in passing by computing the required income change needed to bring about the specified food budget transfer using the food expenditure elasticities computed from the translog demand system. We account for varying supply situations by using two alternative supply elasticity assumptions: (1) unitary supply elasticity (S = 1.0) and (2) zero supply elasticity (S = 0.0).

We simulate the effects of a 10 percent increase in the food budget under alternative targeting and supply elasticity assumptions; the results are shown in Tables 50 and 51. Effects on calorie consumption are presented in Table 50; the corresponding results for protein consumption, in Table 51. In the first case, we look at the percentage change in calorie consumption arising from a nontargeted transfer, i.e. all occupational groups receive a transfer equivalent to 10

Table 50. Percentage change in calorie consumption due to a 10% food budget transfer.

	Luzon					Visayas					Mindanao				
	Urban			Rural		Urban			Rural		Urban			Rural	
	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer
S= 1.0															
Transfer to all groups	-0.33	32.59	0.00	1.51	0.30	-13.76	0.03	0.03	0.51	2.28	-0.14	-2.17	-2.20	0.00	0.00
Transfer to urban semi-skilled & urban unskilled	0.00	4.01	0.00	0.67	0.11	0.01	0.00	0.00	0.12	0.56	0.00	-0.13	0.00	0.00	0.00
Transfer to urban unskilled	0.00	4.01	0.00	0.22	0.03	0.00	0.00	0.00	0.04	0.21	0.00	-0.13	0.00	0.00	0.00
Transfer to farm laborers	0.00	11.42	0.00	0.61	0.00	0.02	0.01	0.01	0.37	0.00	0.00	-0.74	-0.73	0.00	0.00
Transfer to urban unskilled & farm laborers	0.00	15.43	0.00	0.82	0.03	-0.02	0.02	0.01	0.41	0.21	0.00	-0.87	-0.73	0.00	0.06
S= 0.0															
Transfer to all groups	1.62	0.23	-0.18	0.01	0.02	-56.01	10.35	1.86	0.00	77.20	-0.56	1.13	13.36	0.03	0.16
Transfer to urban semi-skilled & urban unskilled	0.02	0.03	-0.03	0.00	0.00	0.63	1.00	0.31	0.00	31.78	0.01	0.08	0.00	0.00	0.02
Transfer to urban unskilled	0.01	0.03	0.00	0.00	0.00	0.23	1.00	0.00	0.00	11.13	0.00	0.08	0.00	0.00	0.02
Transfer to farm laborers	0.01	0.07	-0.07	0.01	0.00	0.74	4.13	0.60	0.00	0.00	0.01	0.35	3.23	0.00	0.00
Transfer to urban unskilled & farm laborers	0.01	0.10	-0.07	0.01	0.00	0.96	5.14	0.60	0.00	11.13	0.01	0.43	3.23	0.01	0.02

Table 51. Percentage change in protein consumption due to a 10% food budget transfer.

	Luzon					Visayas					Mindanao				
	Urban			Rural		Urban			Rural		Urban			Rural	
	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer
S= 1.0															
Transfer to all groups	-1.10	13.89	0.00	1.00	0.40	-2.95	0.44	0.03	0.27	1.34	-0.03	-2.86	-2.95	0.00	0.04
Transfer to urban semi-skilled & urban unskilled	0.00	1.69	0.00	0.44	0.13	0.01	0.00	0.00	0.06	0.33	0.00	-0.17	0.00	0.00	0.01
Transfer to urban unskilled	0.00	1.69	0.00	0.14	0.04	0.00	0.00	0.00	0.02	0.12	0.00	-0.17	0.00	0.00	0.01
Transfer to farm laborers	0.00	4.90	0.00	0.40	0.00	0.03	0.02	0.02	0.19	0.00	0.00	-0.98	-0.98	0.00	0.00
Transfer to urban unskilled & farm laborers	0.00	6.59	0.00	0.55	0.04	-0.04	0.02	0.02	0.22	0.12	0.00	-1.15	-0.98	0.00	0.01
S= 0.0															
Transfer to all groups	2.05	0.29	-0.17	-0.08	-0.06	1.18	10.98	2.15	0.00	58.45	0.01	0.76	12.91	0.11	0.19
Transfer to urban [illegible] illed & urban unskilled	0.02	0.05	-0.03	-0.03	-0.02	0.74	1.05	0.32	0.00	23.42	0.01	0.05	0.00	0.02	0.02
Transfer to urban unskilled	0.01	0.05	0.00	-0.01	-0.01	0.27	1.05	0.00	0.00	8.32	0.00	0.05	0.00	0.02	0.02
Transfer to farm laborers	0.01	0.08	-0.07	-0.04	0.00	1.05	4.43	0.74	0.00	0.00	0.01	0.24	3.31	0.03	0.00
Transfer to urban unskilled & farm laborers	0.02	0.13	-0.07	-0.05	-0.01	1.32	5.49	0.74	0.00	8.32	0.01	0.29	3.31	0.04	0.02

percent of their food budget It is shown that calorie gains are larger (or nutritional losses smaller) if supplies are more elastic Under inelastic supply assumptions consumers with increased food budgets are competing for a fixed supply of goods and the price increase resulting from an upward demand shift will dampen the increase in demand from lower income groups Higher income groups will experience increased nutrient intakes because they can afford to purchase goods even at higher prices This suggests that if supplies are relatively inelastic higher income groups should not be beneficiaries of such transfer programs

Under the unitary supply elasticity assumption calorie gains from a blanket food budget transfer seem to accrue to Luzon-based urban semi-skilled workers Households in the Visayas have minimal gains if at all (in fact calorie consumption by the urban skilled decreases) and households in Mindanao either suffer nutritional losses or are not affected Because of the larger relative importance of Luzon consumers and their generally higher incomes compared to the rest of the country a general food budget transfer would not in general be urban-biased but Luzon-biased within Luzon such a policy would be urban-biased Agricultural workers in the Visayas, however, seem to gain more under inelastic supply elasticity assumptions

Changes in protein consumption arising from a 10 percent food budget transfer follow a pattern similar to that of changes in calorie consumption (Table 51). Under a unitary supply elasticity assumption, the main beneficiaries of the transfer policy are Luzon-based urban semi-skilled workers whose protein consumption may increase as much as 14 percent under a general (blanket) food budget transfer policy. Under inelastic supplies, Visayan farm laborers appear to experience substantial gains in protein consumption. As in the previous case, Mindanao consumers are hardly affected, except for urban unskilled workers under inelastic supplies.

We now turn to variations in targeting schemes. Surprisingly, once market interactions between different groups are considered, nutritional gains do not directly accrue to the targeted groups. For example, regardless of the group which is targeted, Luzon-based, urban semi-skilled workers appear to gain the most from a transfer policy under unitary supply assumptions, and Visayan farm laborers gain when a food budget transfer is given to all groups, to urban semi-skilled and unskilled workers, and only to urban unskilled workers, assuming inelastic supplies. With the exception of unskilled urban workers, Mindanao households do not appear to experience nutritional gains from food budget transfers.

This paradoxical result may be explained in two ways. First, the increase in food budget may be spent on more expensive calorie sources so that the resulting food basket, though purchased at a higher price may actually contain fewer nutrients Secondly recipients of income transfers still have to purchase food through the market, and with the higher prices resulting from increased incomes may still not be able to purchase foods at the higher prices especially if supplies are inelastic

How would a 10 percent food budget transfer come about? One interpretation is that income would have to increase by a certain percentage for the 10 percent food budget transfer to be realized Alternatively we can compute the income transfer required to bring about the specified food budget transfer The elasticity of food expenditure with respect to total expenditure is 0 79 in Luzon and 0 80 in Visayas and Mindanao (Table 45 last column) Dividing the 10 percent food budget transfer by this figure we obtain the following results incomes have to increase by at least 12 65 percent in Luzon and by 12 5 percent in Visayas and Mindanao to bring about the required food budget transfer

7 2 2 Food Price Subsidies

This section compares the effects of targeted and nontargeted price subsidies for three commodities--rice corn and oil--on the nutrient consumption of various occupational groups in different regions

The choice of commodities for the simulation was guided by several considerations First, more expensive commodities consumed mostly by higher income groups are not desirable to subsidize Second, since general price subsidies on all foods are expensive some selectivity is exercised by directing subsidies towards foods that are inexpensive and consumed by the poor and that have desirable nutritional qualities The three commodities chosen are the cheapest in terms of pesos per nutrient unit in 1982, the cheapest was corn (P0 76 per 1,000 kcal), followed by rice (P0 93 per 1,000 kcal) and oil (P1 03 per 1,000 kcal) Third, subsidized foods must be reasonably consistent with existing dietary patterns

Rice corn and cooking oil are reasonable candidates for a subsidy policy Rice is an important component of the Filipino diet is a preferred cereal (especially for low income groups) and has desirable nutritional qualities being the major calorie source as well as a significant protein source Corn is the cheapest calorie source in terms of pesos per nutrient unit as well as the major staple in the Visayas and Mindanao Cooking oil has a high caloric density and is readily digestible, even by children making it easy to use as a calorie supplement In addition, increasing oil consumption not only alleviates calorie deficiency but also aids in the metabolic process by acting as a vehicle for fat-soluble vitamins

Tables 52 to 55 present the results of simulating price subsidy schemes on rice corn and oil under alternative targeting arrangements and supply elasticity assumptions We first discuss the impact on calorie consumption (Tables 52 and 53) and then the effects on protein consumption (Tables 54 and 55)

A 10 percent rice price subsidy under the unitary supply elasticity assumption seems to have very negligible positive effects on calorie consumption except for Visayan farm owners (Table 52) On the contrary there are significant decreases for farm laborers when the subsidies are targeted to them This is due to substitution towards more expensive nutrient sources as consumers experience gains in real income as a result of the subsidy Visayan farm laborers however gain from a rice subsidy if supplies are inelastic (Table 53) Again the effects on Mindanao consumers are negligible

Corn appears to be a promising vehicle for increasing calorie consumption for Visayan rural consumers Under both unitary and inelastic supply assumptions Visayan farm laborers (and farm owners if unitary supply elasticities prevail) experience substantial nutritional gains The gains are even large the more specific the targeting These results do not hold for Luzon consumers who either experience losses or are not affected by a corn price subsidy

Table 52. Percentage change in calorie consumption from 10% food price subsidy, various commodities, unitary supply elasticity.

S= 1.0	Luzon					Visayas					Mindanao				
	Urban			Rural		Urban			Rural		Urban			Rural	
	Professional Technical Entreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer
Rice															
Subsidy for all	0.00	0.43	0.00	0.86	-0.31	0.00	0.00	0.00	11.37	-1.82	0.00	0.01	0.02	0.00	0.00
Subsidy to urban semiskilled & urban unskilled	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	-0.06	-0.01	0.02	0.01	0.01	-0.23	0.00	0.00	0.00	0.00	1.57	0.00	0.00
Subsidy to farm laborers	0.00	-0.01	0.00	-0.05	-30.70	0.06	0.04	0.04	-0.02	-7.91	0.00	0.00	0.00	-0.01	-0.03
Subsidy to urban unskilled & farm laborers	0.00	-0.90	0.00	-0.06	0.31	0.00	0.00	0.00	-0.03	-162.01	0.00	0.00	-0.02	0.00	0.00
Corn															
Subsidy for all	0.00	-2.97	0.00	0.30	-0.04	0.00	0.00	0.00	4.66	0.56	0.00	0.00	0.00	0.00	0.00
Subsidy to urban semiskilled & urban unskilled	0.00	-29.49	0.05	0.21	0.01	-0.01	0.28	0.22	7.05	3.92	0.00	0.01	0.05	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.22	2.53	1.40	0.00	0.00	0.05	0.00	0.00
Subsidy to farm laborers	0.00	-0.09	0.00	0.00	-0.04	0.00	0.00	0.00	15.52	41.94	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	-0.05	0.00	0.00	-0.04	0.00	0.00	0.00	18.04	43.35	0.00	0.00	0.00	0.00	0.00
Oil															
Subsidy for all	0.00	30.66	-0.01	0.81	3.55	0.03	0.04	-0.03	-7.77	-4.48	0.00	-0.04	0.20	0.00	0.00
Subsidy to urban semiskilled & urban unskilled	-0.01	30.59	-1.17	0.20	0.17	-0.33	4.85	3.58	0.39	0.13	0.00	-3.72	20.20	0.00	0.01
Subsidy to urban unskilled	0.00	0.01	-1.17	0.07	0.05	-0.12	-0.11	3.74	0.14	0.04	0.00	0.00	20.21	0.00	0.00
Subsidy to farm laborers	0.00	2.28	0.00	0.12	3.55	0.00	0.00	0.00	0.44	-21.74	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	3.43	-0.01	0.19	3.55	0.00	0.00	0.03	0.58	-21.74	0.00	0.00	0.20	0.00	0.00

Table 53. Percentage change in calorie consumption from a 10% food price subsidy, various commodities, inelastic supply elasticity.

S= 0.0	Luzon					Visayas					Mindanao				
	Urban			Rural		Urban			Rural		Urban			Rural	
	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer
Rice															
Subsidy for all	0.00	0.17	-0.01	-0.09	-0.10	0.00	0.00	0.02	0.02	6.66	0.00	0.00	0.05	0.00	0.00
Subsidy to urban semi-skilled & urban unskilled	0.00	0.18	-0.01	0.00	0.00	0.00	-0.08	0.02	0.00	0.00	0.00	0.00	0.28	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	-0.01	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.29	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	0.00	-0.10	0.00	0.04	0.00	0.00	6.64	0.00	0.00	-0.09	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	0.00	-0.01	0.00	-0.10	0.00	0.04	0.02	0.00	6.64	0.00	0.00	0.21	0.00	0.00
corn															
Subsidy for all	0.00	0.01	-0.02	0.00	0.00	0.00	-0.06	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidy to urban semi-skilled & urban unskilled	0.00	0.00	-0.02	0.00	-0.04	0.00	0.00	-0.03	0.00	11.70	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	-0.02	0.00	0.00	0.00	0.00	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	0.00	-0.04	0.00	0.00	0.00	0.00	11.70	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	0.00	-0.02	0.00	-0.04	0.00	0.00	-0.03	0.00	11.70	0.00	0.00	0.00	0.00	0.00
Oil															
Subsidy for all	0.00	-0.15	0.31	1.70	1.61	0.00	0.26	0.07	-0.06	-4.30	0.00	0.00	1.20	0.01	-0.01
Subsidy to urban semi-skilled & urban unskilled	0.00	-0.16	0.31	-0.02	-0.02	0.00	-1.31	-0.02	0.00	15.21	0.00	0.07	-3.99	0.00	0.01
Subsidy to urban unskilled	0.00	0.00	0.31	-0.01	-0.01	0.02	0.21	-0.05	0.00	5.38	0.00	0.00	-4.94	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	-0.01	1.65	0.07	0.66	0.04	0.00	-42.78	0.00	-0.03	1.58	0.00	-0.05
Subsidy to urban unskilled & farm laborers	0.00	0.00	0.31	-0.01	1.64	0.09	0.88	-0.01	0.00	-37.40	0.00	-0.03	-3.36	0.00	-0.05

Cooking oil holds some potential as a commodity for targeting, although its positive effects are greater when supplies are relatively more elastic. Also, whatever gains there are from oil price subsidies accrue mainly to urban consumers in all regions.

A slightly different pattern emerges when we examine the potential effects on protein consumption. Under a unitary supply elasticity assumption (Table 53), increases in protein consumption from a rice price subsidy are minimal, except for a possible 6.07 percent gain to Visayan farm owners under a general rice price subsidy. However, Luzon and Visayas farm laborers suffer losses in protein consumption when the subsidy is targeted solely to farm laborers or both to the urban unskilled and to farm laborers. Households in Mindanao are hardly affected by the subsidy policy.

Similar to the discussion for protein, Visayan farm owners and farm laborers experience significant protein consumption gains if a price subsidy on corn is implemented. This reinforces the previous conclusion since a corn price subsidy in the Visayas appears to have favorable effects on both calorie and protein consumption.

With regard an oil price subsidy, a general subsidy and a subsidy to the urban semi-skilled and urban unskilled benefit Luzon-based, urban semi-skilled workers as well as Mindanao urban unskilled workers The gain from a subsidy to urban unskilled workers alone is captured mainly by Mindanao urban unskilled workers Finally Visayan farm laborers experience substantial gains in protein consumption from an oil price subsidy to farm laborers alone as well as to urban unskilled workers and farm laborers

Finally we discuss the case of inelastic supplies (Table 55) As expected protein consumption gains are smaller because consumers are faced with higher food prices In the case of a rice price subsidy only Visayan farm laborers experience significant protein consumption gains yet these are only in the magnitude of 3 percent The same group enjoys increased protein consumption with a corn price subsidy but the effects are negligible Finally whatever gains result from an oil price subsidy are minimal in fact Visayan farm laborers suffer relatively large nutrient losses

The above discussion shows that different commodities have varying degrees of effectiveness as subsidy vehicles The minimal gains accruing to disadvantaged groups from a rice price subsidy seems to run counter to the commonly accepted notion that rice is the best commodity for subsidy purposes While rice may be a nutritionally superior commodity the fact that it is consumed by almost all income strata increases the likelihood for

Table 54. Percentage change in protein consumption from 10% food price subsidy, various commodities, unitary supply elasticity.

S= 1.0	Luzon					Visayas					Mindanao				
	Urban			Rural		Urban			Rural		Urban			Rural	
	Professional Technical Entreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer
Rice															
Subsidy for all	0.00	0.10	0.00	0.57	-0.53	0.00	0.00	0.00	6.07	-1.10	0.00	0.01	0.01	0.00	0.00
Subsidy to urban semiskilled & urban unskilled	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	-0.09	-0.01	-0.02	-0.02	0.01	-0.07	0.00	0.00	0.00	0.00	0.86	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	-0.03	-53.12	0.09	0.07	0.05	-0.02	-23.33	0.00	0.00	0.00	0.00	-0.08
Subsidy to urban unskilled & farm laborers	0.00	-0.29	0.00	-0.04	-0.53	0.00	0.00	0.00	-0.02	-110.13	0.00	0.00	0.01	0.00	0.00
Corn															
Subsidy for all	0.00	-1.21	0.00	0.19	-0.08	0.00	0.00	0.00	2.52	0.34	0.00	0.00	0.00	0.00	0.00
Subsidy to urban semiskilled & urban unskilled	0.00	-12.00	0.02	0.19	-0.15	0.00	-0.02	-0.03	3.78	2.37	0.00	0.01	0.04	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	0.02	0.00	-0.05	0.00	0.00	-0.03	1.36	0.85	0.00	0.00	0.04	0.00	0.00
Subsidy to farm laborers	0.00	-0.05	0.00	0.00	-0.07	0.00	0.00	0.00	0.34	26.06	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	0.00	0.00	0.00	-0.07	0.00	0.00	0.00	9.69	26.91	0.00	0.00	0.00	0.00	0.00
Oil															
Subsidy for all	0.00	12.31	0.00	0.52	6.10	0.03	0.03	0.02	-4.18	-2.65	0.00	-0.06	0.27	0.00	0.01
Subsidy to urban semiskilled & urban unskilled	0.00	12.28	0.05	0.13	0.72	-0.26	3.20	2.14	-0.03	-0.68	0.00	-5.70	26.71	0.00	0.05
Subsidy to urban unskilled	0.00	0.00	0.05	0.04	0.23	-0.09	-0.08	2.24	-0.29	-0.24	0.00	0.00	26.71	0.00	0.00
Subsidy to farm laborers	0.00	0.89	0.00	0.00	6.09	0.00	0.00	0.00	-0.93	63.78	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	1.35	0.00	0.12	6.09	0.00	0.00	0.02	-1.22	63.78	0.00	0.00	0.27	0.00	0.00

Table 55. Percentage change in protein consumption from a 10% price subsidy, various commodities, inelastic supply elasticity.

β= 0.0	Luzon					Visayas					Mindanao				
		Urban		Rural			Urban		Rural			Urban		Rural	
	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer	Professional Technical Entrepreneural	Semi-skilled	Unskilled	Farm Owner	Farm Laborer
Rice															
Subsidy for all	0.00	0.16	-0.01	-0.01	-0.03	0.00	0.01	0.03	0.03	2.93	0.00	0.00	0.10	0.00	0.00
Subsidy to urban semi-skilled & urban unskilled	0.00	0.16	-0.01	0.00	0.00	0.00	-0.08	0.03	0.00	-0.01	0.00	-0.01	0.27	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	-0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.28	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	0.00	-0.03	0.00	0.04	0.00	0.00	2.95	0.00	0.00	-0.06	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	0.00	-0.01	0.00	-0.03	0.00	0.05	0.03	0.00	2.95	0.00	0.00	0.22	0.00	0.00
corn															
Subsidy for all	0.00	0.00	-0.01	0.00	0.00	0.00	-0.03	-0.02	0.00	0.00	0.00	0.00	-0.01	0.00	0.00
Subsidy to urban semi-skilled & urban unskilled	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	-0.02	0.00	3.64	0.00	0.00	-0.01	0.00	0.00
Subsidy to urban unskilled	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	0.00	-0.01	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	3.64	0.00	0.00	0.00	0.00	0.00
Subsidy to urban unskilled & farm laborers	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.02	0.00	3.64	0.00	0.00	-0.01	0.00	0.00
Oil															
Subsidy for all	0.00	-0.35	0.30	0.15	0.42	0.00	0.21	-0.02	-0.07	-0.93	0.00	0.00	1.15	0.02	-0.01
Subsidy to urban semi-skilled & urban unskilled	0.00	-0.35	0.30	0.00	-0.01	0.11	-1.45	-0.18	0.00	8.98	0.00	0.06	-2.94	0.00	0.01
Subsidy to urban unskilled	0.00	0.00	0.29	0.00	0.00	0.04	0.22	-0.22	0.00	3.18	0.00	0.00	-3.70	0.00	0.00
Subsidy to farm laborers	0.00	0.00	0.00	0.00	0.43	0.12	0.70	0.07	0.00	-23.65	0.00	-0.02	1.24	0.00	-0.07
Subsidy to urban unskilled & farm laborers	0.00	0.00	0.30	0.00	0.43	0.16	0.93	-0.15	0.00	-20.47	0.00	-0.02	-2.45	0.00	-0.07

leakages in a subsidy scheme. That is, even if only one group (say, farm workers) were to be subsidized, because rice is such an important item on the Filipino diet, other groups would still continue to purchase the commodity even without the subsidy. The increase in real income due to a price subsidy could also make subsidized groups diversify away from cheaper nutrient sources. If rice is to be used as a subsidy vehicle for nutrition intervention schemes, perhaps commodity targeting has to be linked to narrower income-based or geographic targeting to avoid massive leakages to nutritionally adequate groups.

In contrast, because corn is consumed almost exclusively by low income groups in specific geographical regions, leakages to nutritionally adequate groups are likely to be minimal. However, since the positive effects of a corn price subsidy are confined to the Visayas, it is not an appropriate subsidy vehicle in Luzon.

The above results have important implications on the design of targeted intervention schemes. Many subsidy programs use income-related criteria as screening devices. However, these are administratively difficult to implement. On the other hand, the existence of commodities which are consumed in specific geographical areas may provide an additional dimension to designing geographically targeted schemes. The use of geographic targeting to areas where the overall prevalence of malnutrition is high has already been used in pilot food discount projects because of administrative ease (Garcia and Pinstrup-Andersen, 1987). Potential leakage could be further minimized if geographic targeting is used in combination with commodity targeting, taking into account income-related and spatial differences in consumption behavior.

CHAPTER VIII

CONCLUDING REMARKS

This study has attempted to make a contribution to demand analysis and nutrition policy by estimating income-stratum-specific demand elasticities These estimates are then used in a model simulating the potential nutritional effects of market intervention policy The results of this study are therefore useful from two viewpoints that of empirical work on demand systems as well as that of nutrition policy analysis

First the estimates of demand elasticities for both food and nonfood commodities are, by themselves an addition to the literature on consumer demand systems in the Philippines This study is one of the first attempts to apply flexible form demand systems to Philippine data, and the results--particularly the cross-price elasticities which can not be obtained from more restrictive demand systems--can be used in future work requiring such parameters In particular this study has obtained disaggregated demand parameters for the food subgroup accounting for both locational and occupational factors affecting food consumption

The use of the tobit model has also made possible the appropriate econometric treatment of nonconsuming households as well as provided information on the relative sizes of participation and nonlimit consumption elasticities The elasticity decompositions provide insights into the structure of markets and the responsiveness of marginal consumers From a nutrition-oriented perspective the behavior of marginal consumers is important since most of these would belong to nutritionally vulnerable groups What really motivates households to purchase a commodity? If the participation elasticity accounts for a major portion of the total response elasticity then intervention policies aimed at commodities with high participation elasticities are likely to have significant consumption effects e g corn in the Visayas Luxury foods consumed by higher income (and nutritionally adequate) groups fall in the latter category i e those with relatively small participation components of the total price response

Another contribution of this study is its estimation of island-group and occupational-group-specific food demand parameters These have been important in simulating the nutritional impact of food policies Certain insights can be gained from this detailed stratification which cannot be obtained from models which stratify the sample based on the income criterion alone More specifically the geographic and occupational distribution of gains and losses from nutrition policy reveal that general or nationwide policies may only serve to reinforce existing biases--e g for Luzon urban workers While the source of such biases may be traced to policy interventions in pursuit of other goals (e g cheap food to support an industrialization policy, or maintaining a politically important urban constituency) if such biases are reflected in market structures interventions acting through the market may only serve to exacerbate such biases At the same time, the apparently insignificant result of market intervention policies on the nutrient consumption of Mindanao consumers raises a number of questions Given that Mindanao is an area where markets may not be so well developed as in Luzon and Visayas, are interventions acting through the market the most effective form of nutrition intervention? To wait until markets are well developed before addressing nutritional problems is obviously not a solution Rather more direct (or geographically targeted) interventions may be pursued in the short run

The result that targeted groups may not capture the intended gains of nutrition intervention policies requires a better understanding of these groups preferences notably their desire for food vs nonfood items, their propensity to diversify toward more expensive nutrient sources and locality-specific preferences Otherwise general (or blanket) interventions may not only be expensive but may in fact exacerbate the inequalities in consumption they were originally meant to eliminate

The partial equilibrium model used for nutrition policy simulation is limited in that it has not taken into account the general equilibrium effects of market intervention policies on prices and incomes Another phase of this project (refer to Habito 1986) will involve the use of estimated parameters from the production and consumption blocks in simulating the effects of various policies using a computable general equilibrium model To the extent that this study has estimated relatively disaggregated food consumption parameters as well as some parameters for the nonfood system, it will be useful in the context of a general equilibrium approach to agricultural policy modeling

FOOTNOTES

1

A preference ordering, represented by a utility function u = f(q1 ..., qn) is additive if there exists a differentiable function F, F' > 0 and n functions fi(qi), such that F(f(q1..., qn = Σ fi(qi)', i = 1, ..., n Philips, 1974:57). In this case, the utility function is of the form.

(A.1) u(q) = σ {u1(q1) + u2(q2 + ... + u n (qn)}. If (A.1) holds, the Slutsky matrix is diagonal so that the substitution terms S_{ij} are given by:

$$(A.2) \quad S_{ij} = Xq_{yi}q_{yi} \quad \text{where} \quad X = \Phi Y \quad \text{and} \quad \frac{\partial \log \lambda^{-1}}{\partial}$$

or the inverse of the marginal utility of money

2

Among these are the indirect addilog demand system and the Rotterdam demand system. Pante (1977), says that since the two other systems are also derived similarly, (i.e., from utility maximization, the LES, the indirect addilog and the Rotterdam demand system cannot be considered as competitors; however they vary in terms of the degree of restrictiveness allowable in each system. The Rotterdam system, expressed in terms of prices and real incomes, is the most flexible of the three, since it can incorporate additivity, no additivity or partial additivity. The indirect addilog system, like the LES, is based on additivity though the indirect addilog is based on indirect additivity and the LES on direct additivity, while the indirect addilog system allows these to a limited extent.

3

Most of the consumer demand studies conducted in the Philippines are of this type, many consisting of single equation methods without a priori restrictions.

4

A simple exposition of duality in consumer theory can be found in Varian (1978); more detailed discussions in Deaton and Muelbauer, 1980 6:37–50.

5

An aggregate functional form is said to be "flexible" if it can provide a second-order approximation to an arbitrary twice differentiable linearly homogeneous function.

6

Derivation of the adding-up constraint can be found in Swamy and Binswanger (1983:677).

7

Timmer and Alderman (1979), for example, conjecture that the immediate response may be only half of the long-run response, implying an adjustment coefficient of 0.5 in a Nerlovian adjustment model, which is in keeping with what little empirical evidence exists. Timmer and Alderman, however, obtain cross-section results which are more than twice the time-series estimates, which is also the case in Quisumbing's (1985) study.

8

This was pointed out by R. Sah in a discussion.

9

Using the tobit model also rules out double-log models unless the dependent variable is first transformed by adding a positive number, and then performing an adjustment in the computation of the elasticities. Although Belarmino (19983) and Regalado (1984) did not use tobit, they used double-log methods on transformed variables.

10

For a description of these estimates and data sources, see Quisumbing (1985).

11

Howarth Bouis pointed this out during the discussion of the consumption papers at the Workshop on Rice Policies in Southeast Asia Project, Jakarta, August 17–20, 1982.

12

Initial estimates used daily food consumption and food expenditure. However, the results, especially of the [illegible] elasticities, were too small to be plausible. Transformation to monthly data yielded better results similar to previous studies.

[13] The wealth of detail in the FNRI surveys on demographic characteristics permit us to use adult equivalent units (AEUs) in obtaining the figures for consumption per AEU the common practice of using per capita consumption is biased since it does not control for different demographic composition as well as in differential nutritional requirements of household members AEUs take into account the ratio of energy recommended dietary allowances (RDA) of household members by age, sex and physiological state to that of the adult male RDA

[14] This section draws heavily from a Review of Income and Expenditure Data Annex I-A and Comparison of FIES and National Accounts Based on Estimates of Personal Income and Expenditure Annex I-C in World Bank (1980) Aspects of Poverty in the Philippines A Review and Assessment Vol II Main Report Report No 2984-PH

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