Demand Systems from Cross Section Data: An Experiment for Indonesia

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Abstract

A linear version of the Almost Ideal Demand System and the
Multinomial Linear Logit Model are used to estimate Indonesia's food
demand system in order to support policy analysis for Indonesia's
five-year plan. The resulting estimated elasticities vary significantly
across economic levels. These elasticities are evaluated and compared
with other studies in Indonesian and other selected Asian countries.
Policy reforms targeted to changing food prices will cause predictable
results.

Introduction

Policy changes stimulated by international initiatives for financial restructuring have posed significant problems for developing countries that have in the past used input subsidies and low prices for staple foods to protect their low income population (Abbot 1979; Balassa 1984; and World Bank 1986). Changing these policies is a very delicate task; the affected populations are near subsistence and many consumers of the food commodities are also producers (Mellor 1978; Timmer, Falcon, and Pearson 1983). Political instability is possible and an information base for anticipating responses to the initiatives is weak (Streeten 1986; Timmer 1986a). One key set of parameters governing the outcome of these changes in food and income transfer policies is the matrix of consumer demand elasticities. Income, own price, and cross price elasticities are necessary to coordinate agricultural, food, and income policies.

In response to these policy analysis requirements, demand systems methods are being applied to and modified for developing countries. These applications are experimental, frequently substituting strong a priori conditions for the lack of empirical or sample information (Lluch and Powell 1975; Lluch, Powell, and Williams 1977; Ray 1980; Swamy and Binswanger 1986; Banskota et al. 1986). Parameters are required for highly disaggregated demand systems. But with the data available, only demand systems incorporating near or exact separability hypotheses can be estimated. Also, there are few alternatives to compare with the results obtained. In short, policy makers and economists responsible for the supporting analysis are groping for improved capacities to estimate responses to price and income changes.

This analysis contributes to this stream of policy-driven demand systems applications. Indonesia, due to oil price prospects, changes in agricultural production technology, current levels of government debt, environmental concerns, and other factors, is considering reducing its subsidy on agricultural chemicals, pricing water to recover more of its cost and buffering the domestic rice price less relative to world market prices. Rural and urban consumption pattern changes associated with these policies must be correctly anticipated if the agricultural sector is to be properly positioned in the upcoming "repilita" (five-year plan). But the demand studies available for Indonesia, although extensive compared to

many other developing countries do not include much information on cross price effects (Timmer 1971; Boedino 1978; Hedley 1978; Timmer and Alderman 1979; Dixon, Anwar, and Mears 1981; Dixon 1982; Chernichovsky and Meesook 1984). The demand systems estimation exercise reported in this paper was undertaken to support policy analysis for Indonesia's five-year plan.

The Theory

A linear version of the almost ideal demand system (AIDS) and multinomial linear logit model (MLLM) are used to estimate the food demand system for urban Indonesia. The AIDS model allows an evaluation of the compatibility of the estimated system with the restrictions from the individual consumer demand theory. It is among the most flexible of the currently available demand systems models, permitting a wide range of tests of consumer preferences (Deaton and Muellbauer, 1980; Brown, Green, and Johnson 1986). The MLLM satisfies non-negativity and Engel aggregation properties of consumer demand theory. In addition, homogeneity and symmetry restrictions can be imposed by applying linear restrictions on the system parameters. Parameter estimates based on these two demand models are presented to provide users with alternative sets of information and a basis to compare their empirical performance.

Almost Ideal Demand System

A scaled linear version of the AIDS (Deaton and Muellbauer 1980; Ray 1980) with Stone's price index (1953) can be written as

$$w_i = \alpha_i + \Sigma\gamma_{ij}\ln P_j + \beta_i \ln(Y/P\ast) + \Theta_i \ln S, \quad i = 1, \ldots, n, \quad (1)$$

where w_i is average budget share of the ith commodity, p_j is j^{th} commodity price, Y is per capita food expenditure, and S is household size. A geometrically weighted price index, $\ln P\ast = \Sigma w_k \ln P_k$, is used to deflate the income variable. Approximation of the AIDS using this price index has produced empirical results similar to those obtained from the complete nonlinear system (Deaton and Muellbauer 1980; Ray 1980; Brown et al. 1986; Blanciforti et al. 1986).

For the AIDS to be consistent with the properties of individual consumer demand theory, the structural parameters of Equation (1) must satisfy the Engel aggregation ($\Sigma\alpha_i = 1$, $\Sigma\beta_i = 0$, $\Sigma_i\gamma_{ij} = 0$, $\Sigma\Theta_i = 0$), homogeneity ($\Sigma_j\gamma_{ij} = \Theta_i = 0$), and symmetry ($\gamma_{ij} = \gamma_{ji}$). Alternatively,

these restrictions can be tested as behavioral hypotheses implied by the theory of consumer demand.

The demand elasticities corresponding to the linear version of the AIDS are:

$$\epsilon_{ii} = (\gamma_{ii} - \beta_i w_i)/w_i - 1 \quad \text{(own price)}, \tag{2}$$

$$\epsilon_{ij} = (\gamma_{ij} - \beta_i w_j)/w_i \quad \text{(cross price)}, \tag{3}$$

$$\epsilon_{iy} = \beta_i/w_i + 1 \quad \text{(real expenditure)}, \text{ and} \tag{4}$$

$$\epsilon_{iS} = (\Theta_i - \beta_i)/w_i \quad \text{(household size)}. \tag{5}$$

Notice that, unlike the Slutsky restrictions, the values of these elasticities are not independent of the distribution of the budget shares.

Multinomial Linear Logit Model

Allocation of income shares among commodities can be viewed in a probabilistic context (Theil 1969). For the MLLM, these shares are assumed to be given by logistic function

$$w_i = \exp[f_i(X)]/\Sigma \exp[f_j(X)] \quad i = 1, 2, \ldots, n, \tag{6}$$

where w_i is the budget share of the ith commodity and $f_i(X)$ is a vector valued function of the variables (X) conditioning the distribution of the shares among commodity groups. In this study, the function $f_i(X)$ is

$$f_i(X) = \alpha_i + \Sigma\gamma_{ij} \ln P_j + \beta_i \ln Y + \Theta_i \ln S, \tag{7}$$

where p_j is j^{th} commodity price, Y is total food expenditure, and S is household size. This specification is closely similar to the AIDS in Equation 1.

A log transformation of the ratio of the budget shares Equation (6) with Equation (7) explicitly introduced can be expressed as

$$\ln(w_i/w_n) = \tilde{\alpha}_i + \Sigma\tilde{\gamma}_{ij} \ln P_j + \tilde{\beta}_i \ln Y + \tilde{\Theta}_i \ln S \quad i=1,2,\ldots,n-1, \tag{8}$$

where $\tilde{\alpha}_i = \alpha_i - \alpha_n$, $\tilde{\gamma}_{ij} = \gamma_{ij} - \gamma_{nj}$, $\tilde{\beta}_i = \beta_i - \beta_n$, and $\tilde{\Theta}_i = \Theta_i - \Theta_n$. The

version of the MLLM in Equation (8) is linear in the parameters.

The MLLM satisfies the nonnegativity and adding up properties of consumer demand theory. In addition, Slutsky restrictions can be imposed in the parameters to force consistency with the theory (Tyrell and Mount 1982). That is, the parameters can be constrained to satisfy homogeneity $(\Sigma_j \tilde{\gamma}_{ij} + \tilde{\beta}_i = 0)$ and symmetry $[(\tilde{\gamma}_{ij} - \Sigma_k w_k \tilde{\gamma}_{kj})/w_j] = [(\tilde{\gamma}_{ji} - \Sigma_k w_k \tilde{\gamma}_{ki})/w_i]$.

For the MLLM model in Equation (8), the elasticities are

$$\varepsilon_{ii} = \tilde{\gamma}_{ii} - \sum_{k=1}^{n-1} w_k \tilde{\gamma}_{ki} - 1 \quad \text{(own price elasticity)}, \tag{9}$$

$$\varepsilon_{ij} = \tilde{\gamma}_{ij} - \sum_{k=1}^{n-1} w_k \tilde{\gamma}_{kj} \quad \text{(cross price elasticity)}, \tag{10}$$

$$\varepsilon_{iy} = \tilde{\beta}_i - \sum_{k=1}^{n-1} w_k \tilde{\beta}_k + 1 \quad \text{(expenditure elasticity), and} \tag{11}$$

$$\varepsilon_{iS} = \tilde{\Theta}_i - \sum_{k=1}^{n-1} w_k \tilde{\Theta}_k \quad \text{(size elasticity).} \tag{12}$$

Data and Estimation Methods

In Indonesia, as in other developing countries, there are shortages of easily accessible data that can be used in demand systems estimation, so a recent survey was used. Application of the two demand systems, however, required a number of specializing assumptions. The data base, these assumptions, and the simple estimation procedures applied are discussed in this section.

Data

The data used were from a sample of 3,678 urban households.[1] Only information from the survey sections on household food expenditure and demographic characteristics was utilized for the estimation of the two demand systems. Seven food commodity groups[2] were identified using traditional consumption patterns and government policy priorities. Household expenditures on each group were the money value of food purchased, used from inventory, or received as transfers during the survey

period. Total food expenditure, the sum of expenditures on all these food groups, was used as a measure of income variables in the food demand subsystem. Household expenditures on each food group as a fraction of total food expenditure were calculated as household-specific food budget shares.

No market prices were available in the survey data. Price indices for these seven food groups were computed at the district level. District level implicit prices were constructed for individual commodities in each food group. The prices in each group were then geometrically weighted using district-level mean value shares. Implicitly, households in a district were assumed to face similar district-level price indices.[3] Household size, the only demographic variable, was defined simply as the number of persons in a household.

Estimation

The linear AIDS and MLLM were estimated with additive error terms, U_i. For the AIDS, average food budget shares were linearly related to composite food prices, real per capita food expenditure, and household size. In the case of MLLM, the logarithm of the ratio of budget shares was related to the food prices, per capita food expenditure, and household size. The miscellaneous food group, with a sample average budget share of 22 percent, was used as a numeraire in estimating the MLLM.

The additive error terms for each equation for both systems were assumed normal with zero means and constant variances; $U_i \sim IDN\ (0,\ \sigma^2 I)$. A contemporaneous covariance $V(U) = \Sigma \otimes I$, was used, recognizing that the specifications are, in fact, approximations and that food expenditures at each household level are interrelated.

The models were estimated with adding-up, homogeneity, and symmetry restrictions imposed. In the case of MLLM, these restrictions were imposed locally at sample mean budget shares. In order to get consistent estimates, parameter estimates from the more aggregate commodity level were used to restrict the estimates at the disaggregate level (Hassan and Johnson, 1986). To ensure that the covariance matrix was nonsingular, only six budget share equations were estimated. The miscellaneous food group was deleted in the AIDS estimation. The same food group was used to normalize food budget shares in MLLM. An iterative seemingly unrelated

regressions was applied to estimate the structural parameters (Zellner, 1962).

Results

The structural parameter estimates are of interest largely for technical comparisons with other demand systems studies. The elasticities, the key policy parameters, are then reviewed. The elasticity estimates for Indonesia are evaluated and compared with similar system estimates from other studies.

Structural Parameters

Most of the estimated parameters of the AIDS, Table 1, and MLLM, Table 2, were statistically significant. The statistical significance of these coefficients suggests that food demands are responsive to prices, the total food expenditure level, and household size as measured from the survey data. The nature of the demand for food commodities can be directly inferred from the signs of the AIDS parameters. Commodities with negative expenditure parameters ($\beta_i < 0$) are income inelastic, and those with positive parameters ($\beta_i > 0$) are income elastic. From Table 1, the estimated AIDS parameters show that rice was income inelastic and other food groups were income elastic. Similarly, commodities with positive own price parameters ($\gamma_{ii} > 0$) are price inelastic and those with negative parameters ($\gamma_{ii} < 0$) are price elastic. All the own price responses shown in Table 1, except for meats and dairy producers, were price inelastic.

The MLLM parameters measure the relative budget share responses to changes in food prices, total food expenditure, and household size. But, as evident in the expressions in Equation (8), the individual structural parameters for the MLLM cannot be used directly to evaluate and interpret responses to the conditioning variables on food demands. In order to compare the results of the two demand systems, they are converted to estimated elasticities.

Elasticities

Food expenditure elasticities from the AIDS and MLLM are provided in Table 3. Fish, other meats and dairy products, and fruits and vegetables have food expenditure elasticities greater than unity. Rice, the staple

food, has estimated elasticities from the two systems less than unity.
Thus, fish, other meats and dairy products, and fruits and vegetables are
highest ranking by household income responses. Using the approach of
Bieri and de Janvry (1972), food expenditure elasticities were translated
into approximate total expenditure elasticities.[4] Both the AIDS and MLLM
models provided consistent estimated income effects. Elasticities from
the two demand systems show that rice, palawija crops, beans, and fruits
and vegetables are income inelastic. Nonfish meats are income elastic and
fish are borderline.

Household size has the opposite effect of income on food demand
(Table 3). As evident from the signs of the estimated elasticities,
household size has positive effects for staples and negative effects for
expenditure elastic food groups (beans, fruits and vegetables, fish, and
other meats). The estimated elasticities also suggest that increased
household size induces a reallocation away from luxury food groups to
staple food. The average size for urban households was 5.4. A 10 percent
increase in size increased the demand for rice by 6 percent.
Simultaneously, the demand for beans, fruits, and nonfish meats decreased
by 0.5, 2.2, and 6 percent, respectively. The shift away from meats as
household size increased was much stronger than it was for other food
groups.

All the uncompensated own price elasticities for the AIDS and MLLM
provided in Table 4 are negative. That is, changes in own price indexes
had inverse impacts on quantities demanded. For most of the food groups,
the estimated elasticities were less than unity; exceptions were nonfish
meats and beans, which had elasticities exceeding unity. Rice, the staple
food, was the least responsive to changed own price. The absolute values
of these elasticities tended to move closely with food expenditure
elasticities, suggesting that uncompensated own price elasticities
included substantial income effects.

Values of the estimated cross price elasticities suggested that food
demand was responsive to relative price changes. All food groups were
particularly responsive to the price of rice, a key government policy
variable. Alternatively, changes in the price index of other food groups
had less of an impact on the demand for rice. This asymmetry in cross
price effects was partly a reflection of the relatively large share of

household food budgets allocated for rice. Compared to own price elasticities, cross price elasticities generally had lower values. Consumers in general were more sensitive to changes in own prices, but the cross price effects for rice were substantial.

The compensated price elasticities, adjusted for change in real total food expenditure, are given in Table 5. The estimated compensated elasticities suggested that rice and palawija crops were net complements. Rice, fruits and vegetables, and nonfish meats were net substitutes. Likewise, beans, fish, and meats were net substitutes. Fruits and vegetables were net complements to beans, but net substitutes for fish. The two sets of elasticities were inconclusive for rice relative to beans. These quantitative relationships have broad impacts for positioning agriculture to meet consumer demand at administered prices and with rice prices altered.

Comparisons

Demand elasticities of selected foods for a sample of studies for countries are given in Table 6 in order to compare the Indonesian estimates with studies from other countries in the region. Since these studies vary greatly in terms of data bases, reference periods, definition and aggregation of commodities, demand structure, and by method of estimation used, the comparisons must be interpreted cautiously. Still, if the intent is to use these estimates for a policy, it is important to develop the proper perspective about the signs and order of magnitude for effects.

The expenditure elasticities for rice lie between 0.23 (Thailand) and 1.2 (Bangladesh). The elasticities for vegetables range between 0.71 (Thailand) and 0.86 (Indonesia). Our estimates for the two food groups compare closely to those from Kennes' (1983) work on Thailand. Meat is income elastic. The results for fish elasticities, probably because this group includes both fresh and dried products, are the least comparable.

Own price elasticities are all negative. The absolute elasticities of rice vary between 1.30 (Bangladesh) and 0.26 (Indonesia). Vegetables are price inelastic with a minimum value of 0.61 (Thailand). For fish, the elasticities are higher than the elasticities for vegetables in both Thailand and Indonesia. Comparison of meats is especially difficult

because of the nature of the commodity and the lack of homogeneity within the group, but these estimates appear to be high relative to those in the other selected studies.

One may conjecture, at the cost of brevity, that the elasticities exhibit patterns that reflect differences in income levels among these countries. For rice, expenditures as well as own price elasticities tend to decline when moving from lower income countries (Bangladesh and India) to relatively higher income countries (Indonesia and Thailand). In addition, the present estimates, notwithstanding the potential limitations of such comparisons, appear reasonable.

Policy Implications

These demand estimates not only provide information bases to characterize food demand structure, but also provide a complete and consistent framework for evaluating impacts of policy changes. A change in price of a particular food, for example, will set into motion substitution among commodities. The extent of adjustment, of course, will vary among consumers depending on their relative price responses and share of the particular commodity in their budgets. The declining rice prices in Indonesia can be used as an example to illustrate the usefulness of these system-based food demand estimates.

In the Indonesian context, the most important policy intervention is in rice pricing. Beginning in 1969, the Indonesian government sets floor and ceiling prices for rice. Through its national food logistic agency (BULOG), the government procures and distributes rice, regulates flow of rice through private marketing channels, and controls imports to ensure that public prices are in effect.

In the early 1970s, the emphasis of rice policy was on defending the ceiling prices in order to maintain low and stable prices for urban consumers. According to Timmer (1986b), controlling consumer prices for rice was the highest priority from 1966 to 1972. In the middle of the 1970s, the need to raise and defend floor prices became an important policy component as the national sought for self-sufficiency in rice and improvement in farm production and income. For most of the years in which the government intervened, domestic consumer and producer prices of rice have followed the trends in world prices, but at a lower level. Consumer

real prices have remained fairly constant. The government success in defending support prices was partly responsible for the large rice surplus in the mid-1980s.

By 1985, the position of Indonesia shifted from that of importer to exporter in the world rice market. The large domestic rice surplus at a time when the world price of rice was depressed put heavy downward pressure on domestic rice prices. Faced with huge stocks of rice, heavy procurement and storage costs, and limited domestic distribution, the government was unable to effectively defend the floor price. The downward pressure was most likely to be greater on prices of low- and medium-quality rice because of BULOG's selective procurement of high-quality rice.

The decline in rice price has important policy implications because of its sizeable influence on food budgets and allocation patterns. Simulated impacts on food expenditures are given in Table 7 for a 10 percent decrease in price of rice. Since the demand for rice is price inelastic, consumers would decrease their budgets for rice. The decrease is much larger among high-income consumers because of their relative low sensitivity to change in rice prices. Second, expenditures on all other food groups would increase. In the case of fruits and vegetables, and meats, which are net substitutes for rice, the increase in expenditures is reflective of the larger real income effect. Third, the results based on MLLM suggest that the urban consumers would increase relatively greater proportions of their food expenditures on fish and other meats. The AIDS-based estimates indicate that the proportions are greater for palawija and beans. Finally, comparisons of the changes in food expenditures by income group show that the proportional allocations are higher among the lower income consumers. The greater adjustments of this group of consumers are consistent with the larger share of rice in their food budgets and greater relative sensitivity to change in the relative price of rice.

The changes in relative price of rice also have differential impacts on distribution of income. Consumers experience real income gain from the decline in rice price. The low-income consumers are more likely to benefit because of the importance of rice in their budgets. Using change in total food expenditure due to the real income effect of price change as

a measure of income gain, the differential impacts are simulated (Table 7). The results show that the low-income consumers improve their income by an average of 3.7 percent, while the high-income consumers raise by 2.3 percent. The gains for the low-income group are more likely to be higher because of the large presence of low- and medium-quality rice in their budgets.

If the downward pressure on domestic prices is going to prevail in the future, the simulated changes call for policy reform to accommodate consumers' improved economic opportunities. A decrease in price of rice may be necessary to fall below the current floor price in order to lessen storage costs through expended domestic market distribution. Such price setting should, of course, be in line with desired price structure for domestic rice producers. Because the fall in relative price of rice is also associated with increase in demands for other food categories, policy reform should simultaneously consider the impacts on these other foods. Similar system-based demand estimates like the ones in this paper should provide the basis to reduce uncertainties with respect to such policy exercises.

Conclusions

These demand systems estimated for Indonesia should not be viewed as conclusive but simply as adding to the information on urban food demand structure. Even though price variation was limited in a single cross-section, our study demonstrated that it was possible to estimate complete systems food demand parameters. Implicit prices were constructed at the district level to minimize the potential endogeneity problem. But this confined the price variation to only regional diversity. Even with these limitations, the responses based on prices appeared reasonable. Food demands are responsive to change in income, relative prices, and family size.

As evident in our estimates and cross-country comparisons, the elasticities appear to vary importantly across income levels. Food demands of low-income groups are more responsive to changes in income than are those of high-income groups. The low-income groups are also more sensitive to changes in prices of income inelastic foods such as rice.

This responsiveness of the low-income groups probably reflects the more diversified staple diets and/or the high fraction of income these groups allocate to staples.

The general patterns of these elasticities have important policy implications. An income transfer program designed to assist low-income consumers will have a greater impact on demand for staples than it will on that for other foods. A general increase in per capita income or a shift in income distribution skewed to high-income groups is likely to be accompanied with a greater increase in demand for income elastic food commodities, particularly animal products.

As illustrated in our policy exercise, policy reform targeted to change in price of a particular food will have simultaneous impacts on consumption of related commodities. The results suggest that policy makers should take into account consumer adjustments to policy changes in its totality.

Endnotes

1. A subsample of urban households was drawn from the 1980 nationwide
    multipurpose household survey (SURGASAR). The survey was carried out
    by the Biro Pusat Statistik (CBS) during the months of February
    through March 1980.

2. Rice, noncereals and roots, beans, fruits and vegetables, fish, meats,
    and miscellaneous foods. Rice and fish were treated as separate food
    groups because of their importance in the Indonesian diet.

3. Variations in these implicit prices could reflect differences of
    markets and perhaps household preferences. For this analysis it was
    assumed that socioeconomically adjusted households were similar in
    food preferences but had made consumption choices based on different
    relative prices.

4. These elasticities are based on the expressions $\varepsilon_{iy} = \varepsilon_{if} * \varepsilon_{fy}$. ε_{iy}
    is the demand elasticity of commodity i with respect to income. ε_{if}
    is the demand elasticity with respect to food expenditure. ε_{fy} is the
    aggregate food elasticity with respect to total income. For Indonesia
    $\varepsilon_{fy} = 0.76$ was used for the urban sample. The value was determined
    from a share equation of total food expenditure that was conditional
    on food prices, total expenditures and household size.

Table 1. Parameter estimates for the AIDS model with aggregation, homogeneity, symmetry, and consistency restrictions—urban households

| Commodity | Intercept | Price | | | | | | | Real Per Capita Food Expenditure | Household Size |
		Rice	Palawija	Beans	Fruits/ Veg.	Fish	Meats and Dairy Prod.	Others		
Rice	1.27[a] (30.72)[b]	.07 (8.40)	-.01 (-5.25)	-.03 (-4.59)	-.04 (-6.98)	-.03 (-13.66)	-.01 (-6.81)	-.06 (-18.01)	-.17 (36.67)	-.01 (-1.97)
Palawija	.13 (8.82)	-.01 (-5.25)	-.00 (-1.46)	.00 (2.76)	-.00 (-21.44)	-.01 (-3.80)	.00 (3.91)	-.00 (-37.55)	-.00 (-40.08)	-.00 (-29.43)
Beans	.11 (5.00)	-.03 (-4.59)	.00 (2.76)	-.01 (-1.76)	-.02 (-8.22)	.02 (7.46)	.00 (1.99)	.00 (2.16)	.00 (2.10)	.00 (.63)
Fruits/Veg.	-.07 (-2.00)	-.04 (-6.98)	-.00 (-21.44)	-.02 (-8.22)	.05 (10.26)	.04 (9.58)	.00 (2.70)	.01 (6.20)	.02 (5.75)	-.02 (-5.10)
Fish	-.14 (-3.15)	-.03 (-3.80)	-.01 (7.46)	.02 (7.46)	.04 (9.58)	.02 (2.82)	-.01 (-4.79)	.02 (5.31)	.01 (1.99)	.00 (.78)
Meats and Dairy Products	-.31 (-11.63)	-.01 (-6.81)	.00 (3.91)	.00 (1.99)	.00 (2.70)	-.01 (-4.79)	.01 (5.06)	.05 (14.30)	.12 (24.14)	.03 (7.33)

SOURCE: 1980 SURGASAR Data

[a]Rounded to two places.

[b]t-ratios in parentheses.

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Table 2. Parameter estimates based on a Multinomial Linear Logit Model--urban households

	Intercept	Rice	Palawija	Beans	Fruits/ Vegetables	Fish	Meats/ Dairy	Other	Per Capita Food Expenditure	Household Size
$\ln(w_1/w_7)$	2.30[a] (20.57)	0.92 (16.17)	-.04 (-4.58)	-.01 (-.47)	-.04 (-1.26)	-.22 (-7.27)	-.03 (-2.26)	.12 (6.77)	-.71 (-21.20)	.06 (1.93)
$\ln(w_2/w_7)$	-.82 (-4.58)	-.22 (-2.75)	-.02 (-.69)	.09 (2.24)	-.01 (-2.57)	-.11 (-1.90)	-.02 (-.71)	.29 (10.51)	-.01 (-.26)	-.08 (-1.74)
$\ln(w_3/w_7)$	-1.28 (-7.89)	.00 (.03)	.03 (1.44)	-.02 (-.31)	-.53 (-9.95)	.37 (6.16)	-.00 (-.13)	.16 (6.13)	-.01 (-.31)	.06 (1.47)
$\ln(w_4/w_7)$	-1.81 (-3.18)	-.08 (-1.08)	-.02 (-6.28)	-.19 (-10.37)	.23 (6.48)	.07 (2.31)	-.04 (-3.01)	.13 (6.65)	.16 (4.68)	.02 (.47)
$\ln(w_5/w_7)$	-1.33 (-7.11)	-.47 (-7.61)	-.04 (-2.95)	.16 (6.63)	.12 (3.42)	-.08 (-1.44)	-.21 (-9.82)	.18 (6.56)	.34 (6.27)	.20 (4.03)
$\ln(w_6/w_7)$	-2.70 (-15.34)	-.26 (-9.39)	-.04 (-8.00)	-.04 (-4.94)	-.15 (-9.28)	-.29 (-13.99)	-.08 (-3.51)	-.02 (-1.07)	.88 (17.61)	.37 (7.55)

NOTE: The food budget shares are redefined here as w_1 = budget share of rice, w_2 = budget shares of palawija crops, w_3 = budget shares of beans, w_4 = budget shares of fruits and vegetables, w_5 = budget share of fish, w_6 = budget share of animal products and w_7 = budget share of other foods.

[a]Rounded to two places.

[b]t-ratios in parentheses.

Table 3. Mean food budget shares, expenditure and household size elasticities based on Almost Ideal Demand and Multinomial Linear Logit Demand systems

	Almost Ideal Demand System (AIDS)				Multinomial Linear Logit Model (MNLLM)		
Food Group	Average Food Budget Share (W_i)	Food Expenditure Elasticity (ε_{if})	Total Expenditure Elasticity (ε_{iy})	Household Size Elasticity (ε_{is})	Food Expenditure Elasticity (ε_{if})	Total Expenditure Elasticity (ε_{iy})	Household Size Elasticity (ε_{is})
Rice	.30[a]	.43	.33	.56	.32	.24	.64
Palawija	.03	.98	.74	.00	1.01	.77	-.21
Beans	.05	1.09	.83	-.05	1.01	.77	-.06
Fruits & veg.	.15	1.12	.85	-.22	1.13	.86	-.29
Fish	.12	1.06	.81	-.04	1.36	1.04	-.26
Other meats and dairy products	.14	1.84	1.40	-.55	1.85	1.40	-.63

SOURCE: 1980 SURGASAR Data.

[a]Rounded to two places.

Table 4. Matrix of food demand price elasticities based on Almost Ideal Demand and Multinomial Linear Logit Demand systems

| | Almost Ideal Demand System (AIDS) | | | | | | Multinomial Linear Logit Model (MNLLM) | | | | | |
| | Uncompensated Elasticities With Respect to Price of | | | | | | | | | | | |
Food Group	Rice	Palawiga	Beans	Fruits and Vegetables	Fish	Other Meats and Dairy Products	Rice	Palawiga	Beans	Fruits and Vegetables	Fish	Other Meats and Dairy Products
Rice	-.58[a]	-.03	-.08	-.05	-.04	.03	-.26	-.01	.01	-.04	-.14	.02
Palawija	-.55	-.93	.14	-.01	-.29	.12	-.40	-.96	.10	-.01	-.03	.05
Beans	-.67	.07	-1.14	-.47	.47	.03	-.18	.02	-.99	-.52	.45	.05
Fruits & veg.	-.31	-.01	-.16	-.70	.22	.01	-.25	.01	-.17	-.76	.15	.01
Fish	-.28	-.06	.19	.29	-.87	-.08	-.64	-.01	.17	.20	-.92	-.16
Other meats and dairy products	-.36	.00	-.03	-.09	-.16	-1.03	-.44	-.02	-.03	-.07	-.21	-1.03

SOURCE: 1980 SURGASAR Data.

[a]Rounded to two places.

Table 5. Matrix of compensated food demand price elasticities based on Almost Ideal Demand and Multinomial Linear Logit Demand systems

| | Almost Ideal Demand System (AIDS) | | | | | | Multinomial Linear Logit Model (MNLLM) | | | | | |
| | Compensated Elasticities With Respect to Price of | | | | | | | | | | | |
Food Group	Rice	Palawija	Beans	Fruits and Vegetables	Fish	Other Meats and Dairy Products	Rice	Palawija	Beans	Fruits and Vegetables	Fish	Other Meats and Dairy Products
Rice	-.46[a]	-.02	-.06	.01	.02	.09	-.16	-.01	.03	.02	-.10	.07
Palawija	-.25	-.90	.19	.16	-.17	.26	-.29	-.95	.15	.14	.09	.19
Beans	-.34	.10	-1.09	-.31	.60	.18	.12	.05	-.94	-.37	.57	.19
Fruits & veg.	.03	.02	-.10	-.54	.36	.17	.08	.03	-.11	-.59	.29	.17
Fish	.04	-.03	.25	.44	-.74	.06	-.24	.02	.24	.40	-.76	.03
Other meats and dairy products	.19	.05	.07	.18	.06	-.78	.13	.03	.06	.20	.01	-.76

SOURCE: 1980 SURGASAR Data.

[a]Rounded to two places.

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Table 6. Estimated own price and income elasticities of food commodities in selected Asian countries

Study	Country (Location/group)	Demand System	Data Base	Commodity	Elasticity Own price	Elasticity Income
Kennes, 1983	Thailand (Farm Households)	TLES[a]	Aggregate Time series, 1961-1980 and budget Survey, 1975-76	Rice Vegetables Fish Meat	-.39 -.61 -.81 -.39	.24 .71 .54 1.06
	(Non-Farm Households)			Rice Vegetables Fish Meat	-.37 -.61 -.81 -.80	.23 .83 .62 1.03
Timmer and Alderman, 1979	Indonesia (Rural) (Urban)	LGL LGL LGL	Household Survey, 1976	Rice Rice Rice	-1.11 -.84 -.81	.53 .58 .27
This Study, 1987	Indonesia (Urban)	Aids	Household Survey, 1980	Rice Vegetables/fruits Fish Meat	-.58 -.71 -.85 -1.03	.33 .85 .81 1.40
		MNLLM	Household Survey, 1980	Rice Vegetables/fruits Fish Meat	-.26 -.82 -.83 -1.03	.24 .86 1.04 1.40
Swamy and Binswanger, 1983	India	TL	Series of Cross-section Data, 1956-75	Rice	-.70	.94
Pitt, 1983	Bangladesh (Rural-Low Income)	LTB	Household Survey, 1977	Rice Fish	-1.30 -.66	1.19 0.50
	(Rural-High Income)			Rice Fish	-.83 -.97	.94 1.02

[a]Demand systems abbreviated are:
    TLES: Taylor Linearized Expenditure System
    LGL: Log Linear System
    AIDS: Almost-Ideal Demand System
    MNLLM: Multinomial Linear Logit Model
    TL: Transcendental Logarithmic demand system
    LTB: Linear Total Demand Functions

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Table 7. Effect of a 10 percent decrease in rice price on food commodity expenditures and total food expenditure—urban consumers

Food Group	AIDS Based Estimation			MLLM Based Estimation		
	Low Income	High Income	Mean Income	Low Income	High Income	Mean Income
	Percent					
Rice	-3.6	-5.0	-4.2	-6.6	-8.4	-7.4
Palawija	5.4	5.7	5.5	4.8	-3.0	4.0
Beans	6.7	6.7	6.7	2.6	0.8	1.7
Fruits and Vegetables	3.4	2.8	3.1	3.4	1.6	2.5
Fish	3.0	2.6	3.0	7.3	5.5	6.4
Other Meats	7.2	2.1	3.3	5.2	3.4	4.4
Miscellaneous	3.2	3.3	3.1	2.6	0.8	1.8
Food Expenditure Total Price Effect	1.2	1.3	1.2	0.0	0.0	0.2
Real Income Effect	3.6	2.3	3.0	3.8	2.2	2.9

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