The Demand for Food in Burma

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The Burmese economy is an agricultural economy where production, consumption and export are essentially of basic foods. Food production occupies about 80 per cent of the total work force. Rice production alone occupies about half of the total cultivated area and employs about 70 per cent of the work force. Until the early 1960s, Burma had a relatively prosperous economy. It was a leading rice producer and exporter, but has now become barely self-sufficient in the production of rice and other major foodstuffs. A major government policy was the procurement of rice and other foodstuffs. Consumer subsidies were applied to some foodstuffs, especially low grade rice and export taxes were applied to rice. Thriving internal and external black markets in foodstuffs emerged.

In attempting to formulate policies promoting economic recovery in Burma, it is important for policy makers to know something of the magnitudes of the demand for various foodstuffs. The central objective of this study is to estimate the demand functions for a range of important foodstuffs in Burma. These estimates can be used to suggest appropriate food policies given a set of economic growth and welfare objectives for Burma.

The Specification of the Demand Models

Most empirical demand studies use either cross-sectional (household budget) data or time-series data. If cross-sectional data are used. many variables in addition to price and income can be included in the model. Time-series analyse, usually based on aggregate data, have more limitations. Aggregate data cannot show the different preferences of consumers. Thus, the use of aggregate data in a utility context implies that all consumers are represented by a single consumer with a given utility function.

In practice, demand analysts have few options. It is impractical to include all aspects of theory in a model due to data limitations, constraints on modelling, the complexities of theory, and computational difficulties in the estimation procedures. Thus, some simplifying assumptions have to be made. Two assumptions are common. First, consumption per person is assumed for a 'representative' consumer whose behaviour is described by theory. Secondly, only the quantity variables are assumed to be endogenous, with the prices at retail assumed predetermined (Tomek and Robinson 1972). Both assumptions apply to the present study.

In addition, two more assumptions are made with regard to, first, income distribution, and

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secondly, savings. Both the income distribution and savings are likely to affect food consumption (Tomek and Robinson 1972). Due to data limitations, it is assumed here that there is no change in income distribution, and that consumers spent all their incomes during the study period. These assumptions seem realistic in the Burmese context, especially over the period considered (1975 to 1987). The available evidence suggests that real income levels of the large majority of consumers in Burma were low and stable, with few variations over time (see Than and Tan 1990).

Quality variation of the food items under study was largely ignored. An exception is made for rice because it is the most important staple food and quality variation is well-recognised by Burmese consumers. In order to address questions concerning the impact of quality variations on the consumption of rice, three types of rice (low, high and average quality) are considered by including them alternatively in the models specified for estimation.

Consumption of respective food items in this study is generally assumed to depend only on three factors: prices, income and seasonal factors proxied by quarterly intercept dummies. Instead of a time trend variable, quarterly dummies are used in this analysis to represent the seasonal pattern of consumption because seasonal influence on food consumption in terms of seasonal festivals and events are obvious in Burma. It is also reasonable to assume that there have been no major shifts in demand for the food items during the study period.[1]

Data

Aggregate quarterly time-series data consisting of 51 observations from 1975(1) to 1987(3) were used. The data on non-meat basic foods were for Burma as a whole, while the meat data were for 70 townships as specified by the Central Statistical Organisation. The basic data were compiled from various primary sources.[2]

The main sources of data are the publications and records of the Central Statistical Organisation, the Ministry of National Planning and Finance, the Agricultural Corporation, and the Agriculture and Farm Produce Trade Corporation. In the regression analysis, all data were transformed into logarithmic form and expressed in per person and/or per unit per quarter basis. The consumer price index (CPI) at 1969-70 prices was used as deflator. Further data transformations as required were made during estimation of the regression equations.

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[1] A more detailed outline of the demand model is found in Soe (1991).

[2] Most Burmese data are disorganised and scattered, and data collection for Burma is a formidable task. It was initially intended to undertake a household expenditure survey in Burma. However, the prevailing problems in the country made such a task very difficult. Thus it was decided to use time-series data. The task of data collection, compilation and processing took approximately one year.

Commodities and variables

Initially, twelve non-meat basic food items and seven meat items were considered. Based on the preliminary test results of the models, and also considering the relative importance of the commodities in the household budget and the Burmese diet, five non-meat basic food items (garlic, chilli, salt, coffee and sugar) and two meat items (mutton and goat-meat) were excluded from consideration. That left seven non-meat basic food items and five meat items to be considered. Of these, rice is the most important. It was divided into two qualities, with 'low quality' being the rationed rice supplied through government outlets. 'High quality' rice was available on the open market. 'Average quality' rice prices and quantities were the weighted average of low and high quality. The other non-meat items are wheat flour, groundnut oil, sesame oil, pulses, potato, and onion for non-meat basic foods and beef, pork, chicken, duck, and fish for the meat group.

Income is per person quarterly income in kyats. In this study it includes two sub-classifications, namely 'old income' and 'new income'. The 'old income' data were obtained from the *Report to the Pyithu Hluttaw on the Financial, Economic and Social Conditions of the Union of Burma* (various issues) published by the Ministry of National Planning and Finance. The 'new income' was defined as follows:

$$Y^* = Y + RRY$$

where Y^* is the 'new income'; Y is the 'old income'; and RRY is income earned from resale of rationed rice by consumers (resale of low quality rationed rice is relatively common). 'New income' is thus the result of an income redistribution. The income from resale of rationed rice, RRY, was computed by using the following formula:

$$RRY = (QRR*PRSR) - (QRR*PPRR)$$

where QRR and PRSR are quantity of rationed rice and resale price respectively; and PPRR is the purchase price of rationed rice.

Prices refer to retail prices in kyats per kilogram per quarter. The dependent variables considered were quantity consumed for the double-log model and expenditure or income shares of respective food items for the AIDS model. The explanatory variables considered include retail prices of the non-meat basic food items and meat items, per person income (or expenditure), and three seasonal dummy variables.

Selection of the Model

Many models and alternative specifications to estimate demand functions are available. Some of these are directly specified, while others are derived from specific utility functions (Phlips

1974; Raunikar and Huang 1987). The problem of model choice is further compounded by the requirements of statistical inference: the model be specified, the sample data collected, the estimate made, and the hypotheses tested (Tomek and Robinson 1972, p. 336).

Due to the shortcomings in the derived demand systems, specifying an arbitrary set of equations relating quantities to prices and income has been a common practice among researchers. If an arbitrarily specified model possesses the theoretical properties (or allows the imposition of them if the conditions are not automatically satisfied) and is flexible with the ability to approximate the demand system realistically, then that model is an appropriate one.

Considering basic criteria for selecting a model (Fuss, McFadden and Mundlak 1978, pp. 224-5; Fisher and Woodland 1984; p. 1.14, Gujarati 1988, pp. 399-40), the objectives of this study and constraints under which it is undertaken, the almost ideal demand system (AIDS) model and the double-log model are regarded as appropriate. By using the AIDS model, the problems encountered in other derived demand functions such as additive models can be avoided[3]. The theoretical conditions can be imposed and tested conveniently during estimation, if required.

The explanatory power of the AIDS model is recognised in both the developed and developing countries' contexts. For example, Braverman and Hammer (1986, p. 239), who were particularly interested in substitution between alternative staple foods at different income levels, have shown the flexibility of the AIDS model with respect to both price and income elasticities. In demand studies for India, both Ray (1980) and Majumder (1986) strongly recommended the use of the AIDS model in studying demand in developing countries. Other recent applications of the AIDS specification with satisfactory results include studies of household expenditure patterns in Burkina Faso (Savadogo and Brandt 1988) and Tonga (Delforce 1989a); of North American households' demand for convenience and non-convenience foods (Capps, Tedford and Havlicek 1985); of food eaten at home and away from home (Goddard 1983); of the demand for food in Greece (Mergos and Donatos 1989); of food and meat demand for France (Fulponi 1989); and of demand for beef and chicken products for the United States (Eales and Unnevehr 1988).

The double-log model, although violating some theoretical assumptions and being static in nature, is convenient and time saving for its parsimony in parameters, ease of computation and ease of interpretation. The explanatory power of the double-log model, as evidenced by some previous studies (for example, Fisher 1979; de Vega 1981), can also be reasonably good. In consideration of all the qualities outlined above, the AIDS and double-log models were selected for use in a preliminary analysis.

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[3] These problems include the automatic holding of homogeneity and symmetry restrictions in the logarithmic expenditure system model. Although these are implied by demand theory, they often do not hold in empirical studies. In the AIDS model, the homogeneity and symmetry conditions can be tested for or imposed (Delforce 1989b, pp. 2-3).

Specification of the Models

The AIDS model specified below corresponds broadly to that of Fulponi (1989), Mergos and Donatos (1989), Delforce (1989a, 1989b), Chalfant and Alston (1986) and Alston and Chalfant (1987). The estimated model is actually a linear approximation of the strict AIDS model with an expression of prices and unknown parameters being replaced by a known price. This LA/AIDS demand function for good i in expenditure (budget) shares takes the form:

1) $$w_i = a_i + \Sigma_j b_{ij} \log p_j + c_i \log(\frac{Y}{p^*}) \quad (i = 1,...n)$$

The demand model, as specified in equation (1), is modified to include seasonal (quarterly) dummy variables. The estimation equation for non-meat basic food items then becomes:

2a) $$\begin{aligned} w_i^{nm} = {} & a_i^{nm} + b_{ir}^{nm} \ln p_r + b_{iw}^{nm} \ln p_w + b_{igo}^{nm} \ln p_{go} + b_{iso}^{nm} \ln p_{so} + \\ & b_{ipb}^{nm} \ln p_{pb} + b_{ipo}^{nm} \ln p_{po} + b_{ion}^{nm} \ln p_{on} + b_{iga}^{nm} \ln p_{ga} + \\ & b_{ichi}^{nm} \ln p_{chi} + b_{ist}^{nm} \ln p_{st} + b_{isu}^{nm} \ln p_{su} + b_{icf}^{nm} \ln p_{cf} + \\ & c_i \ln (\frac{Y}{p^*}) + d_{i2}^{nm} D_2 + d_{i3}^{nm} D_3 + d_{i4}^{nm} D_4 \end{aligned}$$

where i (= 1,...7) denotes rice, wheat flour, groundnut oil, sesame oil, pulses, potato and onion, respectively. For the meat items the model is:

2b) $$\begin{aligned} w_i^{m} = {} & a_i^{m} + b_{ib}^{m} \ln p_b + b_{im}^{m} \ln p_{in} + b_{igm}^{m} \ln p_{gm} + b_{ip}^{m} \ln p_p + \\ & b_{ic}^{m} \ln p_c + b_{id}^{m} \ln p_d + b_{if}^{m} \ln p_f + c_i \ln (\frac{Y}{p^*}) + \\ & d_{i2}^{m} D_2 + d_{i3}^{m} D_3 + d_{i4}^{m} D_4 \end{aligned}$$

where i (= 1....5) denotes beef, pork, chicken, duck and fish, respectively.

The variables and parameters in these models are defined as follows:

w_i^{nm}	is the income (expenditure) share of non-meat basic food i, i = 1,.. 7;
$\ln p_r$	is the log price of rice (K/kg) per quarter;
$\ln p_w$	is the log price of wheat flour (K/kg) per quarter;
$\ln p_{go}$	is the log price of groundnut oil (K/kg) per quarter;
$\ln p_{so}$	is the log price of sesame oil (K/kg) per quarter;
$\ln p_{pb}$	is the log price of pulses (K/kg) per quarter;
$\ln p_{po}$	is the log price of potato (K/kg) per quarter;
$\ln p_{on}$	is the log price of onion (K/kg) per quarter;
$\ln p_{ga}$	is the log price of garlic (K/kg) per quarter;
$\ln p_{chi}$	is the log price of chilli (K/kg) per quarter;
$\ln p_{st}$	is the log price of salt (K/kg) per quarter;
$\ln p_{su}$	is the log price of sugar (K/kg) per quarter;
$\ln p_{cf}$	is the log price of coffee (K/kg) per quarter;
$\ln Y$	is log income or expenditure (K/person) per quarter;

p^*	is a composite price index (Stone's price index); and
b_{ir}^{nm}	is the coefficient of rice on non-meat basic food i, i = 1,....7;
b_{iw}^{nm}	is the coefficient of wheat flour on non-meat basic food i, i = 1,....7;
b_{igo}^{nm}	is the coefficient of groundnut oil on non-meat basic food i, i = 1,....7;
b_{iso}^{nm}	is the coefficient of sesame oil on non-meat basic food i, i = 1,....7;
b_{ipb}^{nm}	is the coefficient of pulses on non-meat basic food i, i = 1,....7;
b_{ipo}^{nm}	is the coefficient of potato on non-meat basic food i, i = 1,....7;
b_{ion}^{nm}	is the coefficient of onion on non-meat basic food i, i = 1,....7;
b_{iga}^{nm}	is the coefficient of garlic on non-meat basic food i, i = 1,....7;
b_{ichi}^{nm}	is the coefficient of chilli on non-meat basic food i, i = 1,....7;
b_{ist}^{nm}	is the coefficient of salt on non-meat basic food i, i = 1,....7;
b_{isu}^{nm}	is the coefficient of sugar on non-meat food i, i = 1,....7;
b_{icf}^{nm}	is the coefficient of coffee on non-meat food i, i = 1,....7;
d_{i2}^{nm}	is the coefficient for seasonal dummy variable D2 representing the second quarter for non-meat basic food i, i = 1,....7;
d_{i3}^{nm}	is the coefficient for seasonal dummy variable D3 representing the third quarter for non-meat basic food i, i = 1,....7;
d_{i4}^{nm}	is the coefficient for seasonal dummy variable D4 representing the fourth quarter for non-meat basic food i, i = 1,....7;

a_i^{nm}, b_i^{nm}, c_i are the other parameters to be estimated for non-meat basic food i, i = 1,....7;

and

w_i^m	is the income (expenditure) share of meat i, i = 1,...5;
$\ln p_b$	is the log price of beef (K/kg) per quarter;
$\ln p_m$	is the log price of mutton (K/kg) per quarter;
$\ln p_{gm}$	is the log price of goat-meat (K/kg) per quarter;
$\ln p_p$	is the log price of pork (K/kg) per quarter;
$\ln p_c$	is the log price of chicken (K/kg) per quarter;
$\ln p_d$	is the log price of duck (K/kg) per quarter;
$\ln p_f$	is the log price of fish (K/kg) per quarter;
b_{ib}^m	is the coefficient of beef on meat i, i = 1,....5;
b_{im}^m	is the coefficient of mutton on meat i, i = 1,....5;
b_{igm}^m	is the coefficient of goat-meat on meat i, i = 1,....5;
b_{ip}^m	is the coefficient of pork on meat i, i = 1,....5;
b_{ic}^m	is the coefficient of chicken on meat i, i = 1,....5;
b_{id}^m	is the coefficient of duck on meat i, i = 1,....5;
b_{if}^m	is the coefficient of fish on meat i, i = 1,....5;
d_{i2}^m	is the coefficient for seasonal dummy variable D2 representing the second quarter for meat i, i = 1,....5;

$d_{i3}{}^{m}$ is the coefficient for seasonal dummy variable D3 representing the third quarter for meat i, i = 1,....5;

$d_{i4}{}^{m}$ is the coefficient for seasonal dummy variable D4 representing the fourth quarter for meat i, i = 1,....5;

$a_i{}^m$, $b_i{}^m$, c_i are the other parameters to be estimated for meat i, i = 1,....5, respectively.

In some cases where the budget variable is either income or total food expenditure, the CPI is included as a price variable as a proxy for the 'other food prices' omitted from the particular food group being studied.

The double-log model takes the form:

3) $$\ln q_i = b_{io} + b_{i1} \ln p_1 + b_{i2} \ln p_2 +, ..., + b_{in} \ln p_n + c_i \ln Y$$

where:

$\ln q_i$ is log quantity consumed of i, i = 1,...,n;
$\ln p_1,...,\ln p_n$ are respective log prices;
$b_{io},...,b_{in}$ are the parameters to be estimated;
c_i is the income elasticity of demand for good i, i = 1,...n; and
$\ln Y_i$ is log total income (or expenditure) per person per quarter.

Modifying equation (3) to include the seasonal dummy variables and particularly the two food groups, the estimation equations of the double-log model for non-meat basic foods becomes:

4a) $$\ln q_i{}^{nm} = a_i{}^{nm} + b_{ir}{}^{nm} \ln p_r + b_{iw}{}^{nm} \ln p_w + b_{igo}{}^{nm} \ln p_{go} + b_{iso}{}^{nm} \ln p_{so} + b_{ipb}{}^{nm} \ln p_{pb} + b_{ipo}{}^{nm} \ln p_{po} + b_{ion}{}^{nm} \ln p_{on} + b_{iga}{}^{nm} \ln p_{ga} + b_{ichi}{}^{nm} \ln p_{chi} + b_{ist}{}^{nm} \ln p_{st} + b_{isu}{}^{nm} \ln p_{su} + b_{icf}{}^{nm} \ln p_{cf} + c_i \ln Y + d_{i2}{}^{nm} D_2 + d_{i3}{}^{nm} D_3 + d_{i4}{}^{nm} D_4$$

where i (= 1,...7) denotes rice, wheat flour, groundnut oil, sesame oil, pulses, potato and onion, respectively.

For the meat items

4b) $$\ln q_i{}^{m} = a_i{}^{m} + b_{ib}{}^{m} \ln p_b + b_{imt}{}^{m} \ln p_m + b_{igm}{}^{m} \ln p_{gm} + b_{ip}{}^{m} \ln p_p + b_{ic}{}^{m} \ln p_c + b_{id}{}^{m} \ln p_d + b_{if}{}^{m} \ln p_f + c_i \ln Y + d_{i2}{}^{m} D_2 + d_{i3}{}^{m} D_3 + d_{i4}{}^{m} D_4$$

where i (= 1,...5) denotes beef, pork, chicken, duck and fish, respectively; and where

$\ln q_i{}^{nm}$ is log quantity consumed (kg/person) per quarter of non-meat basic food i ,i = 1,....7;

$\ln q_i{}^{m}$ is log quantity consumed (kg/person) per quarter of meat i, i = 1,...5; and the other variables are as defined above.

The double-log model specified above corresponds broadly to that of Main, Reynolds and White (1976) and Martin and Porter (1985). As with the AIDS models, the double-log models with income or total food expenditure as the budget variable also included the variable CPI as a proxy for 'other food prices' not included in the group being studied.

Method of Estimation

The demand equations were estimated simultaneously in a system of equations by using SHAZAM (White, Wong, Whistler and Haun 1990, pp. 152-58). SHAZAM provides a procedure for estimating systems of simultaneous equations or sets of seemingly unrelated regressions, iterative Zellner estimation, or multivariate regression. SHAZAM estimates a set of equations and does a joint generalised least squares procedure by using a covariance matrix of residuals across equations.

While a systems estimation approach is less robust to misspecification errors than single equation estimation, it has advantages in that it provides information to test hypotheses about restrictions directly obtainable from theory (Phlips 1974; Johnson, Hassan and Green 1984). The system approach not only allows the imposition of restrictions but also has the ability to improve the efficiency of the overall set of parameter estimates (Beggs 1987, pp. 14-5).

Imposing Restrictions

Nominal price versions of the systems of equations specified in (2) and (4) were estimated in both unconstrained and constrained forms to test for homogeneity and symmetry properties. Real price models automatically satisfy homogeneity. Tests were made of symmetry in these cases.

The estimated results of the unconstrained estimation and homogeneity constrained estimation were not significantly different in any equation suggesting that the homogeneity property applies. Symmetry was found to apply in most but not all equations in both the non-meat system and the meat system.

Computation of Elasticities of Demand for the AIDS Model

The formulae and procedure used for calculation of elasticities and related statistics of the AIDS model in this study followed Beggs (1988), Delforce (1989b), and Green and Alston (1990).

Income elasticities:

5) $$e_{iy} = \frac{c_i}{w_i} + 1$$

Own-price elasticities:

6) $$e_{ii} = \frac{b_{ii}}{w_i} - (1+b_i)$$

Cross-price elasticities:

7) $$e_{ij} = \frac{b_{ij}}{w_i} - \frac{c_i w_j}{w_i}$$

The method chosen for calculation of elasticities for the AIDS model is also important if reliable results are to be obtained. For example, in a test of alternative methods of calculation of the elasticities of demand in the AIDS models used by analysts, Green and Alston (1990, pp. 442-44) concluded that not all were reliable and correct. According to Green and Alston, the elasticity estimates for any commodity are similar across the AIDS model and the LA/AIDS model using the estimates (5) to (7). Green and Alston recommend these estimators as the ones which provide similar elasticities to the AIDS model although, as pointed out by them, the estimates based on other formulae are also almost identical.

Estimated Results and Interpretation

The estimated results from the AIDS model with total income as an explanatory variable (Tables 1–6) were much better than those from any other specification, including the double-log model with a similar specification. The results from the AIDS model were good in terms of correct signs, extent of significance, consistency, and plausibility, and reflected the observed food consumption behaviour of Burmese consumers.

Thus the following analysis of the estimated consumption functions for food for Burma is based on the estimated results of the AIDS model specified with total income. For the non-meat basic food items, the AIDS model was estimated in three alternative specifications: Model 1 including 'old income' and average rice prices and quantities; Model 2 including 'new income' and high quality rice prices and quantities; and Model 3 including 'old income' and two sets of rice prices and quantities, one for low quality rice and the other for high quality rice, respectively. For meat items only one model specification, namely the AIDS model including 'old income', was estimated due mainly to data limitations.

Income Elasticities

Elasticities in the AIDS model vary as prices and incomes change. Table 1 presents estimated income elasticities for the three types of rice (low quality, high quality, and average), together with that of others in the three alternative model specifications, calculated at the mean values of the data.

The *a priori* expectation was that low quality rice, at least, would be an inferior good, following the work of Ito, Peterson and Grant (1989). However, the AIDS models consistently displayed positive income elasticities for all three types of rice. The income elasticities were also highly significant statistically. The magnitudes varied from 0.2 for low quality rice to 0.9 for high quality rice. Since the income elasticities for all three rice qualities were positive, they are classified as normal goods. Increased income will be followed by increased consumption of all rice qualities, and the increase may be quite large for average rice and high quality rice. This result was more obvious when the estimated results of the three alternative models were compared. Model 1 (lower income) and Model 2 (higher income) recorded 0.6 and 0.9 for average and high quality rice, respectively, while the figures estimated by Model 3 were 0.2 for the low quality rice and 0.7 for high quality rice, respectively. The changing magnitudes of income elasticities with the changes in income and rice prices also indicated that both income and rice prices were important factors in determining rice consumption.

Positive correlation of income and consumption of rice was reasonable in Burma, especially during the study period. Real incomes were low and the majority of households were characterised by under-consumption of even basic foods. A policy implication is that increased supplies of all rice qualities are needed in the short run. It also seems likely that greater supplies of average and high quality rice will also be needed in the long term, as incomes presumably will rise.

The second cereal item considered was wheat flour. Wheat products are 'festive' or 'semi-luxury' foods for the majority in Burma. It seems, however, that they have recently become an increasingly important substitute for rice. As expected, the income elasticities for wheat flour were positive in all models, the magnitude was about 0.8, and the estimated coefficients were also significant.[4]

The non-cereals considered include groundnut oil, sesame oil, pulses, potato and onion, and the income elasticities are also reported in Table 1. The two most widely used cooking oils in Burma are groundnut oil and sesame oil. The Burmese food preparation system is such that dishes without oil are regarded as incomplete . Thus household food expenditure always includes these oils, although the quantity and type may be limited by the budget constraint. Sesame oil is the more expensive, so groundnut oil is more widely consumed than sesame oil.

Pulses are important for both domestic consumption and for export. Domestically, they are a major complement to the main dishes either as soup, or as a mix in the main dish, or in various kinds of snacks. Thus, the quantity demanded domestically is generally high. Recently pulses have become an increasingly important export item. In summary, the estimated results show that the income elasticities for all non-cereals are positive, and income inelastic.[5]

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[4] The coefficients were significent at the 1% level in model 1, 5% in model 2, and 10% level in model 3.
[5] Note however that not all of the estimates for the variables are statistically significant.

Own-price Elasticities

The estimated own-price elasticities for rice and other basic foods are reported in Table 2. All rice types are price inelastic but the magnitudes vary from –0.2 to –0.8 for low quality rice and high quality rice, respectively. All the elasticity estimates are statistically significant. In contrast, the own-price elasticity of wheat flour is high with the magnitude of the coefficients being about 1.0 in all models. All elasticities for wheat flour were also highly significant with large t-values.

The estimated own-price elasticities of all non-cereals were consistent in all models. Normally, a high own-price elasticity characterises a food item as luxury or semi-luxury (Tomek and Robinson 1977), but the unavailability of the item in question due to supply shortage may also cause the own-price elasticity to be high (de Vega 1981). Supply shortages in Burma may have contributed to the high own-price elasticities of non-cereal basic food items. Supply shortages led to increased domestic prices for these items, at least during the study period. This was partly caused by the high priority given to rice (and a few other controlled crops) by government policy which allocated resources to the controlled crops. This severely constrained the production of the crops which were not controlled. In addition, the diversion of a considerable portion of the limited production from domestic consumption to export (both legal and illegal) further compounded the problem of domestic shortage. Thus, domestic prices remained high and as a consequence the expenditure shares remained relatively high over the sample period.

The generally high own-price elasticities of the non-cereal foods suggest that expansion of their cultivation may be profitable for producers. Consumers could also gain from price falls if the supply of the non-cereal foods were expanded. The income effect of such a price fall may increase the quantity of non-cereals consumed to some extent. The income effect will be greater for other major items such as high quality rice or wheat flour, or other quality goods such as meat. Thus the importance of basic items in either production or consumption should be assessed in terms of their impact on the package of foodstuffs. This is important in analysing the impact of alternative government policies. In recent years government policy in Burma has focused on one or a few foodstuffs, rather than the package of foodstuffs that make up the Burmese diet.

Cross-price Elasticities

The cross-price elasticity estimates of the non-meat basic food items are reported in Table 3. The rice to rice relation (model 3 in Table 3) showed that the high quality rice is a substitute for the low quality rice but the low quality rice is a complement to high quality rice. All cross-price elasticities for rice were significant. This showed again that the demand for high quality rice is quite responsive to its own price, and the price of other rices.

Despite the difference in magnitudes, the inelastic or low own-price elasticity for rice recorded in this study was consistent with the often observed phenomenon that a staple food with no close substitutes, and which also accounts for a large share of the consumer's budget, has a low price elasticity. The predominantly complementary nature of other basic food items to rice, as indicated by the cross-price elasticities, was also consistent with the observed food consumption habits of the Burmese.

Among other basic food items, only wheat flour and pulses were observed to be substitutes for rice in model 3. The cross-price parameters were statistically significant (except for the low quality rice and wheat flour relationship) but their magnitudes were quite small being less than 0.1. To summarise, there is no close, important, substitute for rice, and most basic food items are complementary to rice.

When higher income and high quality rice prices were considered, some of the items previously complementary to rice changed either to being independent or substitutes commodities. This might be due to income changes having no influence on the cross-price relationships between rice and related basic food items, or the 'new income' considered in the regressions was not high enough to affect the prevailing cross-price relations of the basic foods.

The characteristics of cross-price relations of rice to rice, and rice to other basic foods observed in this study have important economic meanings and significant policy implications flow from them. The results support the observation that food consumption in Burma is heavily centred on rice and a few basic foods which are consumed in a package. The price of rice, in particular, determines the pattern of food consumption. If the price of rice were changed the mix of food items included in the package is likely to change, rather than the quantity consumed. The implication is that, as long as rice remains as the major staple, the demand for rice and other related basic food items will likely move in the same direction as the rise and fall of rice prices. Continuing increases in the price of rice mean that the quantity of rice, and other foods in the package, consumed will decline. A decrease in rice prices would lead to greater consumption of rice, and an increase in consumer welfare.

The results for wheat flour showed the existence of rice as a substitute as well as many complements. Among the factors that influenced the consumption of wheat flour, rice prices seemed more important than its own price and income. When new income alone was considered in the regression (model 2), only a slight decline in the magnitude of the cross-price elasticity of wheat flour to rice was noted but when new income and average quality rice prices were considered together, the decline was considerable. This suggests that increased expenditure was allocated to rice rather than wheat flour when rice prices increased.

The estimated cross-price elasticities of the non-cereal items are reported in Table 4. Among the non-cereals, groundnut oil and sesame oil were substitutes as expected. Each of pulses, potato, and onion consistently exhibited complementary relations with all other major basic items. The cross-price relations of pulses were statistically significant with rice and groundnut oil, while most of the cross-price coefficients of potato and onion to others were small in magnitude and varied in statistical significance. This outcome was in conformity with that of the cross-price relation of rice and wheat flour to other items as already considered above.

Estimated Results for Meat

Income Elasticities

The income and own-price elasticities for meat items are reported in Tables 5 and 6. Contrary to expectation, the income elasticities for all meat items were generally low. Further, all meat items were classified as normal goods. Beef, pork and chicken have income elasticities of 0.7 to 0.8, while duck and fish have magnitudes around 0.6. All of the income elasticity estimates were highly significant.

Own-price Elasticities

Surprisingly, beef has the lowest own-price elasticity in absolute terms (–0.2), while chicken and duck have the highest. It was noted that the own-price elasticity estimates of chicken and duck were similar in magnitudes (about –1.5) in the homogeneity and symmetry constrained estimation. The magnitudes differed considerably from –1.7 for chicken to –0.8 for duck in the homogeneity alone constrained estimation as reported in Table 5. For all other meat items, both forms of estimation produced consistent and more or less similar results. Among other items, the own-price elasticities for pork were about –0.9 and fish about –0.65. Consumption of chicken, duck, and pork were therefore relatively more responsive to price changes than other meat items. Most of the own-price elasticities for meat items were significant statistically.[6]

Cross-price Elasticities

The cross-price elasticities of meat items are reported in Table 6. Results for the homogeneity and symmetry model are emphasised. All major meat items were indicated as being substitutes for one another with varying magnitudes of the cross-price elasticities. The cross-price elasticities of beef for pork, chicken, duck and fish were highly significant but the magnitudes were small. This indicates that the extent of substitution for other meat items by beef was small.

By contrast, the magnitudes of the cross-price elasticities of chicken as a substitute for pork, and pork as a substitute for chicken, were considerably larger. Fish was found to be a substitute for beef but complementary to chicken and duck. Most cross-price estimates were significant and the magnitudes of the estimates, especially for complements, were large.

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[6] Exceptions are beef in the homogeneity constrained model, and chicken in the homogeneity and symmetry constrained model

Chicken and duck, as expected, were the major substitutes with significant and large cross-price parameters.

In sum, the cross-price elasticities for meat as provided by the models were reasonable and consistent, and realistically reflected the meat consumption habit and food preparation system of Burmese consumers. The characteristics of the cross-price elasticities of meat indicated that the most important meat items in Burma were pork, chicken, duck, and fish.

However, it is unlikely that the supply of meat in Burma will increase in the near future. The livestock industry, except for fishing, is primitive and traditional. In view of the capital intensive nature of modern livestock industry, and the inelastic nature of the demand for meat, it is unlikely that it would be economic to expand it. However, from a nutritional point of view, the prevailing traditional livestock industry needs to be encouraged to increase supply of meat.

Estimated Coefficients of the Seasonal Dummy Variables

As an agricultural country characterised by diverse beliefs and values with various festivals and feasts that are traditional or religious in origin but socio-economic in content, it is it be expected that the influence of these factors on food consumption in Burma might be considerable. The seasonality of food consumption was thus proxied by three dummy variables; D2 for the second quarter, D3 the third quarter, and D4 the fourth quarter, respectively. The detailed results are given in Soe (1991).

A notable feature in the estimated coefficients for the dummies was that the extent and number of significant coefficients for both non-meat and meat generally were for the same season. In the non-meat items, D2 and D4 were significant for rice, D3 and D4 for sesame oil, D2 for pulses and D4 for potato. For meat, the coefficients of D2 and D4 were significant for beef and chicken, D2 and D3 for pork , and D3 and D4 for fish. The most obvious and consistent ones were D2 and D4 for both meat and non-meat items. This feature largely corresponds with the seasonal pattern of the festivals and the farming activities, as well as the use of foods 'in a package'.

The importance of economic factors in food consumption was also indicated by the dummy coefficients in that the significant levels in terms of the magnitudes of t-values changed considerably with the change in income levels and rice prices. For example, the coefficient of D2 for rice was significant only at 0.10 level in Model 1 but changed to 0.01 level in Model 2, suggesting that rice consumption is related more to changes in income levels and rice prices (economic factors) than to changes in seasonal or socio-cultural factors.

In sum, the estimated coefficients for dummies were consistent, reasonable, and realistic in the context of the Burmese food system, food consumption habits, and other socio-cultural and traditional features. The complementary and substitution nature of the items were also realistically identified, and the seasonal shift of expenditure between food items was also reflected.

Concluding Remarks

This study has shown that it is possible to estimate the demand for foodstuffs in Burma. The estimates for income elasticity of demand, own price elasticity of demand and cross price elasticity of demand were consistent with generally accepted economic theory, applied to the case of a very low income country. One obvious result of the study is to demonstrate the necessity of collecting basic economic statistics, even in very poor countries. Clearly, the study could not have been conducted if the data on food consumption and income had not been available in Burma.

The study also demonstrates the need for dedication to the task of preliminary data screening, and to econometric model specification. As in many previous studies, the AIDS model gave estimates for the demand systems that are consistent with economic theory.

Finally, it is reasonable to use the estimates for income elasticity of demand, own price elasticity of demand and cross price elasticity of demand to make policy recommendations for governments. Few such recommendations are made in the part of the demand study reported in this paper. Interested readers are referred to Soe (1991), for a more complete view of policy recommendations based on the econometric estimates of the demand for food in Burma.

Appendix

Table 1 Income Elasticities for Non-meat Basic Foods: Homogeneity and Symmetry Constrained AIDS Model[a]

Variables	Model 1	Model 2	Model 3
Rice (low quality)	–	–	0.23*
			(4.28)
Rice (high quality)	–	0.88*	0.73*
		(52.40)	(12.13)
Rice (average quality)	0.57*	–	–
	(14.99)		
Wheat flour	0.82*	0.77**	0.80#
	(4.44)	(2.19)	(1.84)
Groundnut oil	0.39*	0.29*	0.29*
	(4.80)	(3.45)	(3.68)
Sesame oil	0.90*	0.75*	0.65*
	(5.79)	(5.84)	(5.45)
Pulses	0.49*	0.68*	0.87*
	(5.51)	(7.62)	(10.67)
Potato	0.34	–0.35	–0.52
	(0.99)	(–0.95)	(–1.27)
Onion	0.26	0.32#	0.28#
	(0.96)	(1.75)	(1.92)

[a]The figures in parentheses are t-values. Significance levels: * 0.01; ** 0.05; and # 0.10.

Table 2 Own-price Elasticities for Non-meat Basic Foods: Homogeneity and Symmetry Constrained AIDS Model

Variables	Model 1	Model 2	Model 3
Rice (low quality)	–	–	–0.15*
			(–3.12)
Rice (high quality)	–	–0.84*	–0.74*
		(–159.4)	(–10.40)
Rice (average quality)	–0.65*	–	–
	(–27.34)		
Wheat flour	–1.00*	–0.99*	–0.99*
	(–54.23)	(–47.18)	(–42.59)
Groundnut oil	–0.97*	–0.97*	–0.97*
	(–25.47)	(–26.06)	(–26.03)
Sesame oil	–1.00*	–1.00*	–0.99*
	(–37.46)	(–47.98)	(48.85)
Pulses	–0.98*	–0.99*	–1.00*
	(–33.17)	(–35.64)	(–36.79)
Potato	–0.79*	–0.69*	–0.59*
	(–78.79)	(–78.58)	(–65.29)
Onion	–0.99*	–1.00*	–0.98*
	(–57.61)	(–90.28)	(–69.02)

Table 3 Cross-price Elasticities of Cereals: Homogeneity and Symmetry Constrained AIDS Models

Variables (Log price)	Model 1: Average rice	Model 1: Wheat flour	Model 2: High qual rice	Model 2: Wheat flour	Model 3: Low qual rice	Model 3: High qual rice	Model 3: Wheat flour
Rice (average quality)	–0.37**	1.11*	–	–	–	–	–
	(–2.63)	(4.76)					
Wheat flour	0.10*	–1.00*	–	–	–	–	–
	(4.94)	(–54.23)					
Rice (high quality)	–	–	–0.60*	1.72*	–	–	–
			(–14.45)	(6.32)			
Wheat flour	–	–	0.04*	–0.99*	–	–	–
			(6.49)	(–47.18)			
Rice (low quality)	–	–	–	–	–0.15*	–0.02#	0.35
					(–3.12)	(–1.92)	(1.52)
Rice (high quality)	–	–	–	–	0.33#	–0.74*	1.92*
					(1.80)	(–10.40)	(6.27)
Wheat flour	–	–	–	–	0.33	0.05*	–0.99*
					(1.52)	(6.32)	(–42.59)
Groundnut oil	–0.21*	0.71**	0.04*	–1.11*	–1.00*	0.07*	–1.07**
	(–5.71)	(2.15)	(3.09)	(–3.02)	(–3.74)	(4.34)	(–2.79)
Sesame oil	–0.08**	0.29	–0.01	0.70**	–0.33#	0.01	0.37
	(–2.64)	(0.96)	(–0.76)	(2.35)	(–1.79)	(0.84)	(1.30)
Pulses	0.11*	–1.07*	–0.01	–0.46	0.73*	–0.06*	–0.64**
	(3.53)	(–3.86)	(–0.86)	(–1.58)	(3.11)	(–3.86)	(–2.28)
Potato	0.05*	–0.02	0.02*	–0.16	–0.12	0.05*	–0.20
	(4.48)	(–0.12)	(5.43)	(–0.98)	(–0.88)	(5.44)	(–1.07)
Onion	0.10*	–0.21	0.02*	–0.23#	–0.05	0.06**	–0.66*
	(8.66)	(–1.46)	(5.22)	(–1.91)	(–0.38)	(2.02)	(–3.16)
Garlic	–0.08**	–0.16	0.03**	–0.39**	–	–	–
	(–2.93)	(–1.02)	(2.61)	(–2.46)			
Chilli	–0.04#	0.14	–0.02**	0.09	–0.03	–0.03**	0.08
	(–1.83)	(1.31)	(–2.00)	(0.76)	(–0.29)	(–2.29)	(0.58)
Salt	–0.04	–0.00	–0.15*	0.75*	0.70*	–0.13*	0.55**
	(–1.33)	(–0.03)	(–13.05)	(4.60)	(3.89)	(–9.15)	(2.66)
Sugar	0.03	0.37	0.11*	–0.76	0.23	0.11*	–0.60
	(0.75)	(0.13)	(6.73)	(0.40)	(1.07)	(4.80)	(–0.79)
Coffee	0.12*	–0.39*	–0.07*	0.26#	0.31**	–0.08*	0.29
	(5.52)	(–3.53)	(–5.46)	(1.69)	(2.48)	(–5.04)	(1.58)
R^2	0.89	0.50	0.99	0.36	0.96	0.996	0.37

Table 4 Cross-price Elasticities of Non-cereals: Homogeneity and Symmetry Constrained AIDS Model

Variable Log price	Groundnut oil	Sesame oil	Pulses	Potato	Onion
Rice	−0.53*	−0.59**	0.42*	1.76*	1.94*
	(−5.43)	(−2.86)	(3.63)	(4.70)	(8.69)
Wheat flour	0.16**	0.17	−0.32*	−0.04	−0.32
	(2.20)	(0.95)	(−3.83)	(−0.11)	(−1.43)
Groundnut oil	−0.97*	1.02*	0.32*	0.28	0.42
	(−25.47)	(6.77)	(3.21)	(0.39)	(1.21)
Sesame oil	0.38*	−1.00*	−0.17#	0.26	−0.27
	(6.90)	(37.64)	(−1.76)	(0.38)	(−0.97)
Pulses	0.23*	−0.34#	−0.98*	−0.55	−0.53
	(3.23)	(−1.83)	(−33.17)	(−1.10)	(−1.34)
Potato	0.02	0.05**	−0.06	−1.00*	−0.32*
	(0.39)	(2.46)	(−1.11)	(−78.85)	(−6.09)
Onion	0.06	−0.11	−0.09	−0.56**	−1.00
	(1.18)	(−1.01)	(−1.37)	(−2.18)	(−57.69)
Garlic	−0.04	−0.31**	0.11	0.34	0.38**
	(−0.70)	(−2.47)	(1.51)	(1.25)	(2.04)
Chilli	0.08	0.20**	−0.01	0.02	0.13
	(1.66)	(2.41)	(−0.28)	(0.13)	(0.87)
Salt	−0.13**	0.37*	0.09	−0.15	−0.16
	(−2.06)	(3.15)	(1.28)	(−0.56)	(−0.82)
Sugar	0.09#	−0.09	−0.13	−0.52	−0.97*
	(1.74)	(−0.51)	(−1.28)	(−1.31)	(−3.21)
Coffee	−0.20*	−0.39*	−0.05	−0.70*	−0.21
	(−3.87)	(−3.98)	(−1.00)	(−3.27)	(−1.35)
R^2	0.88	0.81	0.86	0.70	0.53

(Since the cross-price elasticities of non-cereals as displayed by the three alternative model specifications are more or less similar, the results of Model 1 alone (including old income and average rice) are reported).

Table 5 Own-price and Income Elasticities of Meat: Homogeneity and Symmetry Constrained AIDS Model

	Own-Price Elasticities		Income Elasticity	
Variable–Log price	Homogeneity	Homogeneity and Symmetry	Homogeneity	Homogeneity and Symmetry
Beef	−0.18	−0.20*	0.67*	0.77*
	(−0.59)	(−13.94)	(12.26)	(14.17)
Pork	−0.95*	−0.80*	0.82*	0.82*
	(−9.50)	(−7.62)	(23.03)	(21.61)
Chicken	−1.70**	−1.56	0.75*	0.78*
	(−2.68)	(−1.19)	(12.95)	(14.85)
Duck	−0.83**	−1.51**	0.61*	0.67*
	(−2.12)	(−2.10)	(11.62)	(5.98)
Fish	−0.56*	−0.69*	0.65*	0.62*
	(−3.88)	(−6.73)	(22.89)	(22.83)

Table 6 Cross-price Elasticities of Meat: Constrained AIDS Model

Variable	Homogeneity constrained					Both homogeneity and symmetry constrained				
Log price	Beef	Pork	Chicken	Duck	Fish	Beef	Pork	Chicken	Duck	Fish
Intercept	0.05*	0.14*	0.11*	0.04*	0.55*	0.04*	0.15*	0.10*	0.04*	0.57**
	(13.72)	(13.85)	(8.16)	(16.63)	(22.73)	(16.09)	(17.54)	(9.79)	(7.66)	(–2.74)
Beef	–0.18	0.73*	0.20	0.40	–0.47**	–0.20*	0.002*	0.003*	0.004*	0.01**
	(–0.59)	(3.64)	(0.60)	(1.32)	(–2.91)	(–13.94)	(4.92)	(4.19)	(2.89)	(14.26)
Pork	0.24	–0.95*	0.37**	–0.04	0.07	0.02*	–0.80*	0.39**	–0.07	0.02
	(1.51)	(–9.50)	(2.29)	(–0.24)	(0.85)	(4.28)	(–7.62)	(2.72)	(–0.24)	(0.43)
Chicken	0.05	0.50	–0.70**	–0.11	0.21	0.01*	0.31**	–1.56	2.14**	–0.21**
	(0.10)	(1.28)	(–2.68)	(–0.18)	(0.67)	(4.28)	(2.70)	(–1.19)	(2.40)	(–2.74)
Duck	0.30	–0.11	1.20**	–0.83**	–0.44**	0.002*	–0.07	0.43**	–1.51	–0.05#
	(0.75)	(–0.42)	(2.81)	(–2.12)	(–2.10)	(4.28)	(–1.52)	(2.39)	(–2.10)	(–1.86)
Fish	–0.19	–0.63*	–0.67**	0.08	–0.56*	0.04*	0.02	–0.80**	–1.00#	–0.69*
	(–0.68)	(–3.47)	(–2.28)	(0.28)	(–3.88)	(4.28)	(0.14)	(–2.83)	(–1.88)	(–6.73)
Mutton	–0.31	0.07	–0.88**	0.22	0.62*	0.32	0.21	–0.91**	0.49	0.43**
	(–0.99)	(0.36)	(–2.63)	(0.72)	(3.77)	(0.96)	(0.89)	(–2.87)	(0.75)	(2.64)
Goatmeat	–0.80**	–0.56**	0.54	–0.35	–0.31#	–0.31	–0.60**	0.51	–0.56	–0.39**
	(–2.28)	(–2.49)	(1.48)	(–1.03)	(–1.72)	(–0.95)	(–2.66)	(1.53)	(–0.80)	(–2.41)
R^2	0.86	0.87	0.52	0.94	0.95	0.81	0.80	0.47	0.91	0.93

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