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9. ABSTRACT

In all countries, particularly developing countries, growth rates alone do not provide an adequate measure of economic development. It is necessary to look at other indices, including the nutritional status of the population. This paper analyzes aspects of this issue by considering the demand pattern for various key foods. Those preferences are then related to the "revealed demand" for nutrition. This study of West Pakistan is based largely on the household surveys conducted by the government of Pakistan. First, the "demand" for nutrition is established under the assumption that tastes are a given. Because income is a primary determinant of nutrient intake, malnutrition in low-income classes may be reduced by either direct or indirect income supplements. This would require some institutional changes. Secondly, the demand for various food groups is analyzed. Quality effects are introduced by developing a model for consumer demand. The results indicate that as income rises, most people spend a high portion of the increased income on higher priced foods. This suggests that even without any income increase, people above the lowest income level can improve their nutritional status by purchasing lower priced varieties of food. Thus, programs designed to adjust people's tastes toward more nutritionally efficient consumption patterns warrant careful consideration. Various policy options to achieve improvement in nutritional status are discussed.

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NUTRITION, FOOD AND PRICES IN PAKISTAN

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Abstract

This report analyzes some of the issues involved in determining nutritional status. The empirical work relates to West Pakistan and is largely based on the household surveys conducted by the government of that country. The work may be viewed in two parts.

In Part One the "demand" for nutrition is determined under the assumption that tastes are given. Income is one of the primary determinants of nutrient intake so that in this framework the prevalence of malnutrition of low income classes may be significantly reduced by either direct or indirect income supplements. This would of course require some institutional change.

In Part Two the demand for various food groups is analyzed. Quality effects are introduced by developing a model for consumer demand which is somewhat different from traditional approaches. The results indicate that as income rises in most instances people spend a portion of the increase on larger quantities, but much of the increase goes on higher priced varieties. This suggests that even without any increase in income those above the lowest income level can significantly improve their nutritional status by purchasing lower priced varieties. Thus programs to adjust people's tastes toward more nutritionally efficient consumption patterns warrant careful consideration. Various policy options to achieve improvement in nutritional status are discussed.

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Some of the data were collected during a visit to Pakistan in June 1974 while a lot of information was sent to Cambridge since then. Among the numerous people who were extremely helpful in this connection I would like to express my appreciation in particular to Nemat Ilahi, Planning Division, Government of Pakistan, and Nasir Jafri, U.S.A.I.D., Islamabad.

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INTRODUCTION.

In all countries growth rates alone do not give an adequate measure of economic development. For developing countries in particular it is necessary to look at some other indices which reflect equity, income distribution and welfare criteria. Among these are the nutritional status of the population.[1] This paper analyses some aspects of this question by considering the demand pattern for various key foods and those preferences are then related to the "revealed demand" for nutrition. For Pakistan eleven foods and four nutrition components are considered. These are listed in Appendix 1, together with the coding for all variables used in this analysis. Some general comments preceed the analysis which for convenience is handled in two parts.

In the first part the nutrition demand is considered while the second part analyses the demand for individual foods. The nutrition issue is analysed by estimating the demand[2] for calories, fat, animal and vegetable protein under the assumption that tastes are given. The demand for foods on the other hand is analysed by proposing a model of consumer behavior different from neoclassical tradition. This model allows one to incorporate quality effects into the utility function. The primary findings of this analysis are:

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[1]There is a considerable body of literature dealing with how and indeed whether investment in nutrition programs may be justified on purely economic grounds. In this work this is not considered an issue. (Shultz, 61, 71; Levinson and Abbott, 74; Selowsky and Taylor 3.)

[2]People don't actually demand nutrition. Nutritional preferences are revealed by a linear transformation of the demand for food. Animal and vegetable protein are treated separately in the analysis but from a nutritional point of view there is no basis for considering either one a better source of protein.

1) That significant determinants of nutrient intake are household income, food price, household size, urban-rural status. This is the subject of Part I.

2) As income rises people typically spend more on food but much of the increase goes to higher priced varieties rather than into increases in the quantity consumed. The implications of this price effect on policy are considered primarily in Part II.

GENERAL BACKGROUND.

Household Survey.

The empirical work is largely based on the data given in the Government of Pakistan household surveys for the four years 1968 - 1972. In particular these surveys give the average quantity and expenditure for various foods by different income groups. The data are collected by direct interview so one may expect food estimates to be overstated. Information is also available on total expenditure, household size, number in each group sample and urban-rural status. For a particular food, say wheat, the ratio of expenditure to quantity purchased by an average household in any one income group gives an imputed price. However, this price varies by as much as a factor of two or three across groups for many food items. The reason for this variation in price may be considered a generalised "quality" effect.

This observation suggests that it is not very satisfactory to assume a conventional formulation of a consumer maximising a utility function $u(x)$ subject to an income constraint $p'x \leq y$, $x \geq 0$ where x is vector of quantity of goods purchased, y is income and p the price vector. A cursory look at the data indicates one may not realistically model such large price variations by an error in variables model.

The problem of explicitly modelling the outcome of consumers' behavior is developed in Part II. The model estimated is a modified version of:

$$x_i = f\ (E,\ H,\ D,\ p_i^*,\ J)$$
$$q_i = g\ (E,\ H,\ D,\ p_i^*,\ J) \qquad i = 1,\ 2,\ \ldots,\ 11$$

where x_i is per capita quantity consumed of food group i, E is total expenditure per capita, H is number of members of household, D reflects the urban-rural status , J job status and p_i^* is price of food group i paid by the lowest income group, while q_i is a measure of the quality of food purchased.

Engel Curves.

The choice of an appropriate functional form for f( ) has been discussed at length in the literature (Houthakker (1957), Prais and Houthakker (1971), Phlips (1974), and is typically limited to the linear, semi-logarithmic and double-logarithmic. Because of some statistical instability the groups with incomes below 50 rupees / month and above 1500 rupees / month were excluded. Approximately 1% and 2% of the population are in these groups. For the income range under consideration the double logarithmic form was chosen.[3] The linear model does not adequately reflect satiety effects at higher income levels and while the semi-logarithmic form is advocated by Prais and Houthakker particularly for food, the choice was made in this instance partly to facilitate the inclusion of household size and the computation of elas-

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[3] The relation between these empirical models and consumer theory is discussed by Houthakker in "The influence of prices and incomes on household expenditures." Bulletin of the International Institute of Statistics 37 (1960) and also "Additive Preferences" Econometrica 28 (1960) 244-257.

ticities. The exclusion of the lowest income group essentially removed the difficulties encountered in a double-logarithmic form caused by zero expenditure on some foods.

A double logarithmic form is also chosen for g ( ). A preliminary study of the data suggests this form as a reasonable model. The variation in q_i with prices is discussed in more detail in Part II, where the theory leading to this model is developed. The model actually estimated is

$$\log x_i = \alpha_{0i} + \alpha_{1i}\log E + \alpha_{2i}\log H + \alpha_{3i}D + \alpha_{4i}\log p_i^* + \alpha_{5i}J + \varepsilon_{1i}$$

$$i = 1,\ldots,n$$

$$\log q_i = \beta_{0i} + \beta_{1i}\log E + \beta_{2i}\log H + \beta_{3i}D + \beta_{4i}\log p_i^* + \beta_{5i}J + \varepsilon_{2i}$$

where D is one or zero for urban and rural households respectively, J is one or zero depending on whether the head of the particular household is self-employed or not, and $\varepsilon_{1i}, \varepsilon_{2i}$ random errors uncorrelated with the dependent variables. The choice of these variables is now discussed.

Choice of Variables.

The theory developed in Part II is based on the assumption that all consumers have similar utility functions. Under this assumption the consumer's demand for various foods is a function of income and price. In order to reflect the more realistic differences in people's utilities some further variables are included. The choice of these variables is based on empirical observation and study of the Pakistan millieu but of necessity is to some degree a value judgement.

Consumer behavior and expenditure patterns in particular are determined by the complete history of income including that from wealth. Expenditure for any observation time may be biased and is likely to result in offsetting

expenditure behavior at other times. In making the typical permanent vs. transitory income comparison, classification by income group rather than expenditures is chosen, these being the two choices available. Total expenditure E, for all items including food, is chosen as an independent variable. Since expenditure on any one food group E_i is at most .3E and more typically less than .1E a sufficient range of variation exists to minimize the effect of errors in the independent variable. This approach is perhaps not as desireable from a theoretical point of view as a simultaneous equation model which would include complementary and substitution effects explicitly but nonetheless these effects may be deduced from the results obtained here without the concomitant difficulties of the alternate approach.

The second independent variable is household size. The hypothesis is that per capita expenditure is affected by economies of scale achieved by larger households while larger households also tend to have more earners. The value used is the total number of members per household. It is desireable to have a more disaggregated measure to reflect actual composition by age, sex and occupation, and in particular for nutrition planning, information on pre-school children and pregnant and lactating women as important target groups.

The third variable is the dummy D to reflect rural-urban status. Again there are many regional and seasonal factors which do merit analysis but again data was limiting. The hypothesis is that for a rural household with size and income similar to an urban household one would expect that the latter would spend less on food in general because of the higher housing and transportation costs of urban living.

The fourth variable used is job-status. This is an attempt to account for some of the effects of social status. One would like some estimate of the demonstration effect of Ragnar Nurskse. There is also strong evidence that demand is to a large extent socially conditioned. The job status variable here is simply to indicate whether the head of household is self-employed or not. Kuznets (1966) has advanced the theory that such people would tend to save more to accumulate capital. If one considers the Galbraith view of advertising, it is of interest to see how extensive its influence may be. This would require some measure of advertising impact for which data are not readily available.

Price Variations.

An imputed price is obtained by dividing expenditure on a food group by the quantity of that food. At any one time these prices show considerable variation with income group, typically rising from low to high groups. There are many factors which account for these variations and may be viewed from two points of view. The first is to account for these different prices of the "same" intrinsic food and secondly, to develop a hypothesis for some households' willingness to pay these higher prices. There are, typically, aggregation problems. Thus food group one includes wheat and wheat flour. One would expect the consumption of higher income groups to be biased towards a higher proportion of flour and consequently a higher price. Secondly there is a multi-dimensional generalized quality of the commodity. For example many varieties of rice are consumed and again one would expect the consumption of higher priced varieties to rise with income. Third is the ratio of home to cash purchases. This in turn reflects the additional costs of packaging and

service ranging from the individual attention of small shops to the less convenient but cheaper service at outlets which specialize in bulk sales. Fourth is the question of regional and seasonal variations. In urban areas one tends to have more ration shops per capita but also a greater variety: The former would offer lower price opportunities for necessities while the latter would admit a wider range of prices. Seasonal variations are most pronounced where storage and transport facilities are least developed. Finally there are the problems of price discrimination sometimes arising from discriminating monopolistic behavior but often being rooted in social status. While some attempts have been made at modelling quality effects, see for instance Griliches (1971), and it would be desireable to model all these phenomena, unfortunately it is extremely difficult.[4]

The imputed price p for any food group i may be viewed as a function of an intrinsic price p_i^* and these generalized quality traits of that food group q_{il} $i = 1, 2, \ldots n$.

$$p_i = \pi(p_i^*; q_{i1}, q_{i2}, \ldots, q_{in})$$

A variation in the imputed price p_i reflects the net effects of changes in the intrinsic price and in the quality measures. As economies develop it is observed that the nonprimary component of consumption expenditures particularly for food tends to increase. This means that the part largely received by

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[4] See also Fisher, F.M., and Shell, K. "Taste and quality change in the pure theory of the true cost-of-living index". in Value, Capital and Growth, Essays in honor of J.R. Hicks, J.R.N. Wolfe, (ed.), Oxford, 97 - 139, 1969. In their approach they introduce the idea of quantity augmenting or disembodied taste change similar to some of the concepts used in capital theory.

agriculture tends to decrease. Kuznets has recorded the phenomena with some detail for Sweden.[5] It would seem that a family with limited resources could improve its nutritional status by buying foods with a higher primary content. However for a planner to try to bring this about involves many issues not the least being that of consumer sovereignity. In this study the $\pi(\ )$ function is not estimated but the imputed price offered by various households is analyzed. This market outcome presumably results from consumer preferences for various quantitites of goods when facing the intrinsic prices and the available array of qualities for each. It is not implied that income level explains the variation in price but rather that it is one of the variables which enter into a consumer's decision on what quantity and quality he desires and these decisions are reflected in his expenditure at an imputed price on a good.

The hypothesis offered here is that the generalized quality as reflected in the imputed price is a function of household size, total expenditure and urban-rural status. One expects higher expenditure households to buy higher quality varieties. Among high income groups one would expect larger households to buy the more expensive flour instead of wheat[6] as household size is a

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[5] Kuznets analyzed the PTD component (processing, transportation and distribution) for food expenditures in Sweden and the United States. For Sweden PTD as a fraction of food expenditure went from .36 (1891-1900) to .47 (1921-1930) while for the United States it went from .32 (1909) to .56 (1949-1957).

[6] One cannot overemphasize the aggregation difficulties. In West Pakistan for the "wheat" category for example there are a great many varieties ranging from red to white, from low extraction whole wheat to refined high extraction flour. In addition one should be mindful of regional variations for example corn is relatively more popular in the Punjab.

good proxy for number of earners. Urban households should pay a higher price both because of the greater variety available and the predominance of cash as opposed to home purchases. For further discussion of some of these issues the reader is referred to a study on Indian food consumption patterns,[7] under the chairmanship of Mahalanobis (1969).

PART I - NUTRITION

Nutritional Status.

The problems of malnutrition may be subdivided into two broad categories (1) protein-calorie malnutrition (P.C.M.) and (2) specific nutrient defficiencies: iron, iodine, vitamin A, riboflavin. Technically, one may eliminate the second category in, say, a five-year period by appropriate planning without too much distortion in resource allocation.[8] The first category, P.C.M.,

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[7] The report of the Committee on Distribution of Income and Levels of Living under the chairmanship of P.C. Mahalanobis was published in two parts. Part II (July 1969), entitled "Changes in Levels of Living" analyses in detail many of the distribution effects in India resulting from changes in food prices during that country's First and Second Five Year Plans.

[8] For further discussion of various case studies see Berg,A.; Scrimshaw, N.S.; Call, D.L.; (eds) Nutrition, National Development and Planning . M.I.T. Press 1973. Also Berg, A.; "The Nutrition Factor" in Brookings Institution, 1973. The iodization of salt in Caldas (Colombia) reduced goiter rate among children from 83% in 1950 to 33% by 1952 and 2 % in 1965. The cost of such a program is of the order of a few cents per capita; see Pardo, F.R.; Rueda-Williamson and Mora, J.O.; Le efectivad de la sal en la prevención del bocio endemico en Colombia. Archivas Latinamericanos de Nutrición 18: 7, 1968.

is in many ways more difficult. In this study four components are analysed: calories, vegetable protein, animal protein and fat consumption, and for convenience the intake of these four components is viewed as a measure of nutrient intake. Three models are considered for the intake of each of these nutrients. One is a function of total household expenditure,(EH), urban-rural status, (D), while the others also include household size (H), a food price index (FI), and job status (J).

$$N_i = h_1 \ (EH, D) \qquad 5$$

$$N_i = h_2 \ (EH, D, H, FI) \quad i=1,2,3,4. \qquad 6$$

$$N_i = h_3 \ (EH, D, H, FI, J) \qquad 7$$

The hypothesis is that as total expenditure rises one would expect caloric intake to increase while there would be a shift to animal protein away from vegetable protein. Because of higher housing and transport costs urban households should have lower nutritional status than a corresponding rural group. Household size is a proxy for adult/child ratio. This ratio being lower for large households should be reflected in lower average nutrient consumption. The FAO food price index FI is used.[9] As overall food prices rise one expects a shift towards cheaper cereal food and hence higher caloric intake and away from animal protein.

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[9] The FAO food price index for West Pakistan is used. The values are given under the consumer price index. This index is based on the typical food consumption basket for industrial workers in Karachi.

The specific forms chosen are again double logarithmic

$$\log N_i = \beta_{0i} + \beta_{1i}\log EH + \beta_{2i}D + \varepsilon_i \qquad i = 1,2,3,4. \qquad 8$$

$$\log N_i = \beta_{0i} + \beta_{1i}\log EH + \beta_{2i}D + \beta_{3i}\log H + \beta_{4i}\log FI + \varepsilon_i \qquad 9$$

$$\log N_i = \beta_{0i} + \beta_{1i}\log EH + \beta_{2i}D + \beta_{3i}\log H + \beta_{4i}\log FI + \beta_{5i}\log J + \varepsilon_i \qquad 10$$

where β_{ji} are constants and ε_i, errors uncorrelated with independent variables. There are a number of issues in nutrient intake which are not considered here, in particular the problems of complementarity and the aggregation problem of using a per capita measure. Certain combinations of foods are particularly desireable from a nutritional standpoint. Thus the synergism of pulses when used in conjunction with other cereals results in a joint amino acid composition and protein score superior to both separately. On the other hand protein without adequate carbohydrate may be of little use, W.H.O. (73), Altschul.

The aggregation of various members of a household masks the different requirements of adult male, female and children.[10] There have been a number of attempts to construct an equivalent standard but these have not been too fruitful. Typical weights might be 1.0 for adult male, .85 female (1.25 when pregnant) and 0.80 for a 6 year old child as suggested by Chugtai and Khan(1960).

The quantity of a given food is used to estimate nutritional content. It is assumed that price variations do not reflect any variation in nutritional value.[11] In some instances a unit of a higher priced variety may be

[10] Some attempts have been made to analyse intrafamily or household behavior. Levinson identified significant nutritional status differences between young boys and girls in his study, Morinda: An Economic Analysis of Malnutrition Among Young Children in Rural India. Cornell-M.I.T. International Nutrition Policy Series, 1974.

[11] In fact in some instances there may be a perverse relationship. The expensive varieties of high extraction flour typically do not contain any of the beneficent bran so common in the cheaper varieties.

less nutritious. Thus the nutrition components for each income group are obtained by an appropriate transformation T of the food quantity vector F.

$$N = T\,F$$

where N is 1 x 4, T is 4 x 11, and F is an 11 x 1 vector of the food group quantities. The elements of the T matrix are based on the values quoted by Chughtai and Khan, and Bowes and Church (1970).

Econometric Considerations.

Equations 8, 9, and 10 are estimated for each of four nutrients by generalized least squares. For each income group the average total expenditure and expenditure on each food group are available, together with number of households on which the estimate is based. This information is used to (1) adjust for the error resulting from assuming $\log \bar{x} = \overline{\log x}$ due to the concavity of the log function and (2) correct for heteroscedasticity.

Each total expenditure is adjusted for the cost of living index and each food expenditure by the food price index. These quantities are obtained from the FAO yearbook.

Since log is a concave function for any group classification $\log \bar{x}$ will equal $\overline{\log x}$ only when all observations x_i within the group are equal to $\bar{x}$. Otherwise $\log \bar{x}$ will be an overestimate by an amount δ. The approximation used for δ in this analysis is $\frac{1}{12}\,\frac{\Delta^2}{\bar{x}^2}$ where $\bar{x}$ is the mean and Δ the range of values for x_i in that group. Details are given in Appendix 2.

The values for the variables in each income group, Y_i are based on n_i households. Thus the variance of the variables is proportional to $\frac{1}{n_i}$. Consequently each variable is given the appropriate weight by multiplying

by n_i. The Cochrane-Orcutt approach is used for autocorrelation. This procedure uses a least squares regression to form an initial estimate of the first order serial coefficient, ρ. A regression is then run on the transformed data and the process is iterated until $\hat{\rho}$ changes by less than 0.005.

Regression Estimates.

Double logarithmic formulations and data from all four years are used throughout. Table 1.1 lists for all income groups the coefficients of the regression of each of four nutrients against various variables. For example in the six variable regression the entry $\underset{(.12)}{1.04}$ would be interpreted as follows. A one per cent increase in expenditure EH would result in a 1.04 per cent increase in the animal protein intake per capita. The standard deviation is 0.12 indicating a high degree of statistical significance. The three variable regressions were run mainly for income group specific analysis where lack of data created a problem for the statistical stability of six and five variable regressions. An interpretation of the final column in Table A3.1 is

$$CA = e^{11.04}\ FH^{.082}\ D^{-.12}$$

giving $CA = 53{,}700\ EH^{.082}$ urban households

$CA = 63{,}000\ EH^{.082}$ rural households

Where CA is caloric intake per capita per month and E is household expenditure per month in rupees.* It is noted that estimates are given in Tables A3.5 and A3.6 for urban and rural populations separately.

The results for the various foods are given in Part II.

Nutrition Results.

The six-variable regressions are given in Table 1.1 and 1.2 while

*Rs. 9.90 = U.S. $ 1 (effective February 1973)

TABLE 1.1 ALL INCOME GROUPS
REGRESSION FOR LOG OF NUTRIENT INTAKE
ON THE LOG OF DIFFERENT VARIABLES

COEFFICIENTS OF	NUTRIENT PVL	PAL	FATL	CAL
C	8·51 (·57)	7·70 (1·01)	10·23 (2·34)	12·56 (·59)
EHL	·15 (·07)	1·04 (·12)	·41 (.28)	·286 (·069)
DL	-·14 (·018)	·011 (·03)	·041 (·07)	-·146 (·018)
HL	-·21 (·10)	-·76 (·17)	-·017 (·41)	-·30 (·10)
FIL	-·18 (·11)	-·17 (·20)	-·677 (·466)	-·20 (·12)
JL	·05 (·55)	·20 (·09)	·039 (·22)	-·038 (·053)
R^2	·9999	·9994	·9979	1·000
D-W	2·23	1·09	2·07	2·2

Interpretation:

$\log_e$ (CA) = 12.56 + 0.286 $\log_e$ EH - 0.146D - 0.30 $\log_e$ H - 0.20 log FI - 0.038 J where CA is cals/capita/month, EH is expenditures rupees/household/month. D=1 for urban dwellers, 0 for rural, H is size of household, FI is the FAO food price index and J=1 for self-employed head of household, otherwise 0.

The dependent variables PVL, PAL, FATL, CAL are the logs of vegetable protein (gms), animal protein (gms), fat (gms) and calories/capita/month, respectively. All variables are listed in Appendix 1.

TABLE 1.2. VARIOUS INCOME GROUPS

REGRESSION COEFFICIENTS FOR LOG OF NUTRIENT INTAKE

COEFFICIENTS OF	LOW INCOME GROUP 1 (50-99)				MIDDLE INCOME GROUP 5 (250-299)				HIGH INCOME GROUP 10 (1000-1499)			
	PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	14·89 (·74)	11·77 (2·27)	11·19 (11·97)	17·35 (2·32)	7·65 (2·5)	8·39 (·96)	-·72 (11·5)	10·33 (2·49)	9·23 (4·55)	13·17 (9·07)	17·75 (1·635)	15·8 (3·0)
EHL	2·85 (·21)	1·5 (·64)	1·42 (3·3)	2·65 (·65)	1·29 (·94)	2·56 (·36)	3·66 (4·25)	1·52 (·92)	·063 (·04)	·30 (1·28)	1·09 (·23)	·34 (·43)
DL	-·21 (·027)	·19 (·08)	·046 (·44)	-·15 (·086)	-·27 (·09)	-·30 (·03)	·54 (·40)	-·14 (·08)	-·52 (·18)	-·27 (·36)	-·097 (·065)	-·44 (·12)
HL	-2·41 (·19)	-1·6 (·58)	-1·43 (3·1)	-2·3 (·60)	-1·9 (·87)	-3·2 (·33)	2·1 (3·98)	-1·13 (·86)	-1·02 (·68)	-1·77 (1·36)	-·65 (·24)	-·79 ·45
FIL	-·42 (·12)	-·78 (·37)	-·42 (1·95)	-·25 (.58)	·63 (·62)	·60 (·23)	·61 (2·8)	·53 (·60)	·019 (·74)	-·75 (1·48)	-2·10 (·27)	-·68 (·49)
JL	-·51 (·12)	·79 (·37)	·90 (1·96)	-·16 (·38)	- ·20 (·36)	-·72 (·13)	·32 (1·6)	-·03 (·35)	- ·63 (·48)	-·80 (·96)	- ·46 (·17)	-·58 (·31)
R^2	1·0	·999	·997	1·0	1·00	1·00	·998	1·00	1·00	·999	1·0	1·0

Variables are given in Appendix 1. Incomes are in rupees/month.

Appendix 3 contains five and three variable regressions in Table 3.3.for all income groups and for low A3.2 medium A3.3 high A3.4 income groups separately while urban and rural groups are given separately in Tables A3.5 and A3.6.

The overall aggregate picture may be seen in Table 1.1. Here one observes that the expenditure elasticity for calories is 0.286 while that for animal protein is considerably higher at 1.04 while vegetable protein is only 0.15. The size and high degree of statistical signficance for these parameters indicates the fundamental importance of expenditure as a determining factor in nutrient intake. An urban dweller consumes less calories and vegetable protein than a corresponding rural dweller, i.e. one with the same expenditure and from similar household size. The effect of household size is negative for each nutrient intake. Similarly all intakes are inversely related to price. Job status is found to be positive and statistically significant for animal protein intake. This indicates that those households whose head is self-employed tend to consume more. Aggregation problems can be quite misleading in analyzing the job status variable for all income groups. The independently employed among low income groups may be typically farmers while entrepreneurs may constitute a large section of that class in the high income brackets. So "self-employed" means a different social role at different income levels. To obtain more insight one may consider the regressions for various income groups as in Table 1.2. To appreciate the income distribution structure some of the data produced by Nasseem (73) are given below. The variables are now discussed in more detail.

1. Expenditure Effect.

For each income group and for all nutrients the expenditure elasticity

is positive. As income rises the expenditure elasticity for calories falls. In the low income group this elasticity is significantly greater than one. (S.S.)* The high expenditure elasticity for animal protein compared to vegetable protein indicates the typical higher-income group members' propensity to have most of their protein from animal sources. As one moves along income classes for each nutrient the expenditure elasticity shows a tendency to fall reflecting the typical behavior observed by Engel. For low income group 1 where survival is a predominant factor the expenditure elasticities are greater than one, those for vegetable protein and calories being S.S. Even for the middle income group expenditure elasticities are above one. Since less than fifty per cent of the population are in higher income groups (Table 1.3) the problem warrants careful consideration.

2. Household Size.

The effect of an increase in household size is negative for most nutrient intakes per capita. This may partly reflect the higher children/adult ratio in larger households. However the picture becomes clearer when one examines the individual food demand structure.

3. Food Price Index.

In general for each nutrient the price elasticity is negative. While the values for these coefficients for individual income groups are N.S.S. the results indicate that for the urban households all nutrient intakes exhibit S.S. negative price elasticities. The particularly high value for fat results from the consumption pattern for dairy produce. As people consume

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*S.S. and N.S.S. will be used to indicate statistically significant and not statistically significant at the 5% level. This may be loosely interpreted by appealing to the Central Limit Theorem as follows. For a large number of members of the low income group one would expect that 'on average' at least 95% of them would have expenditure elasticity greater than one.

TABLE 1.3

ESTIMATE OF DISTRIBUTION OF INCOME GROUPS

FOR WEST PAKISTAN 1969-70

Income Group	URBAN (SAMPLE SIZE∿24,600)		RURAL (SAMPLE SIZE∿14,600)	
	Percentage of Group Population to Total Population	Cumulative Percentage	Percentage of Group Population to Total Population	Cumulative Percentage
Less than 50	-	-	.81	.81
50-99	2.0	2.0	7.75	8.6
100-149	10.6	12.6	23.1	31.7
150-199	15.6	28.2	21.6	53.2
200-249	16.7	44.9	16.8	70.0
250-299	12.9	57.8	10.3	80.3
300-399	18.1	75.9	11.2	91.5
400-499	9.8	85.7	4.5	96.0
500-749	7.8	93.5	2.8	98.8
750-999	3.1	96.6	1.1	99.9
1000-1499	1.6	98.2	0.4	100.3
1500-1999	0.9	99.1	0.2	100.5
2000 and above	0.9	100		

Source: Nasseem, S.M., "Mass Poverty in Pakistan: Some Preliminary Findings." The Pakistan Development Review, pp. 317-352, Winter 1973.

Incomes are in rupees/month.

more they tend to pay a higher price. This is contrary to what standard neoclassical theory has to say. The price effect is considered at length in Part II.

4. Urban-Rural Location.

The coefficients for DL indicate that in general urban households consume S.S. less amounts of vegetable protein and total calories than a rural household of similar size having the same total expenditure. This is partly explained by the extra expenditure incurred by urban dwellers for housing and transportation. However the statement may be a little misleading because urban dwellers typically earn higher incomes and indeed more than enough to compensate. The situation is illustrated in Figure 1.1 for 1971-1972. Here the rural curve lies above the urban curve at each income level. However the higher urban income levels more than compensate. A household with average* urban income of 350 rupees / month has per capita intake of 3180 calories/day, while the figures are 220 and 2860 for the average rural family. One must bear in mind that the values reflect in part the slightly inflated estimates one typically obtains with a survey carried out by interview. The relative measures are somewhat more reliable. Nevertheless since more than 50% of the population are in income groups below these average levels one must surmise that a large segment of the population in 1971-1972 does not have the minimum daily requirements suggested for Pakistan of about 2700 calories (Chugtai and Khan).

5. Job Status.

The coefficients for job status are generally N.S.S.; however, one may make a few observations. Particularly in low income groups the self-employed

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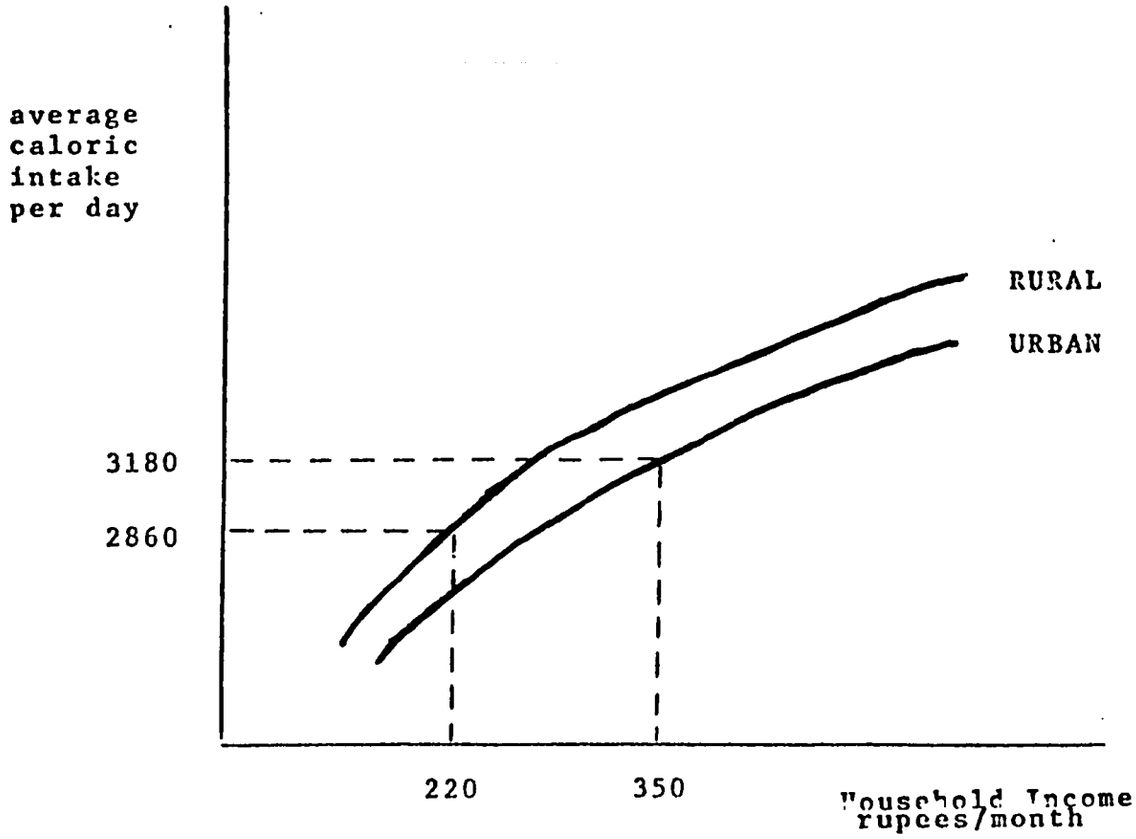
*average as reported in the Household Survey for 1971-1972.

FIG. 1.1

CALORIC INTAKE - HOUSEHOLD INCOME, WEST PAKISTAN, 1971 - 1972



consume higher levels of animal protein but lower levels of vegetable protein. This reflects in part the behavior of farmers who form a large segment of the "self-employed" population in the low income group category. While there are still many farmers among the high-income group "self-employed" there is a noticeably higher number of professional and sales workers. This may account for the fat and caloric consumption being SS lower among high income self-employed. However, the evidence is fragmentary and warrants closer investigation.

General Comments

Analysis such as this does not get into sufficient detail at the micro-level. However it does have the advantage of using data currently available to give a general feel for the P.C.M. status of population. What emerges is a picture showing that nutrient intake is to a high degree dependent on expenditure which is in turn closely related to income, and to a slightly lower degree on the price of foods, household size, urban-rural location and job status.

Thus while the household size and urban-rural location merit consideration, policies aimed at improving nutrient intake should primarily address the income and pricing questions.

A short answer is to improve the supply side and increase purchasing power on the demand side. There are a number of techniques available for stimulating supply; making inputs, fertiliser, water, seeds, credit more readily available[12]. This analysis is however more concerned with the

[12] Many of these issues are considered in a collection of studies by Gotsch, C.H.; and Falcon, W.P. Linear Programming and Agricultural Policy: Micro Studies in the Pakistan Punjab (forthcoming). They show the results of improving irrigation, mechanization, credit availability and also investigate the issue of multiple cropping patterns.

demand side. Basically one may allocate either by using a price mechanism or by quantity.[13] One can make foods cheaper or incomes higher. Of particular interest is the variation in prices for basically similar foods. This variation in most instances exceeds 100%! Thus for a given amount of expenditure consumers who tend to buy higher priced varieties can achieve a significant improvement in intake by purchasing lower priced varieties. This suggests some possibilities for policy. These are discussed at length in Part II.

The fact that larger households tend to have lower intake per capita merits closer analysis. Thus the average may be lower due to the presence of more children whose needs are lower or due to economies of scale. It is really necessary to examine behavior within the household to see what is actually happening. There have been cases recorded where higher household consumption actually resulted in reductions for some members.[14]

The lower nutrient intake of rural dwellers might be improved by an extension of the ration shop system in these areas or by stimulating the supply side. This would in turn have the

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[13] For an excellent analysis of some of the theoretical considerations involved in deciding on whether the price mechanism or rationing may be best used see Weitzman, M.L. "Prices vs. Quantities" MIT Department of Economics, Working Paper 106 April 1973 (forthcoming in Review of Economic Studies).

[14] Gross and Underwood record the situation in Northeastern Brazil where the increase in income accruing to sisal workers was more than outweighed by the energy demands on their labor so that nonproductive dependents were systematically deprived; see "Technological Change and Calorie Costs: Sisal Agriculture in Northeastern Brazil." American Anthropologist, Vol. 73, pp. 725-740, 1971.

added benefit of raising the rural real wage and thus slowing the rural-urban migration pattern.[15]

Perhaps the most obvious way to improve nutritional status is via income. The high expenditure elasticities for nutrients among low and even up to middle income households in particular suggests that most of any increase in income goes to increasing nutrient intake. Thus it is desirable that policy which hopes to effect an improvement in nutritional status for these groups should consider increasing income either directly or indirectly. This may be done by stimulating the supply side of those foods which are particularly favored by these groups. In Part II a slightly different approach is suggested by seeking to modify demand patterns to favor a more "nutritionally effective allocation" of consumer expenditure. If one is unwilling or cannot effect tastes then one is inevitably led to consider how the income variable might be modified. In particular it is of interest to see how significant it really is.

Effect of an Income Transfer

One approach is to consider what the effect would be on food and nutrition of an income transfer. The urban sector for 1969-70 is chosen. Let it be assumed that those in the upper ten percent

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[15] In order to ease the rural-urban migration problem a number of authors have advocated improving the lot of the rural relative to the urban population by various policies such as wage subsidies or production subsidies to agriculture, see for example, Harris, J. and Todaro, M. "Migration, Unemployment and Development: A Two-Sector Analysis," American Economic Review, March 1970 or Bhagwati, J.N. and Srinivasan, T.N., "On Reanalyzing the Harris-Todaro Model: Policy Rankings in the Case of Sector-Specific Sticky Wages." American Economic Review, June 1974.

income level, (incomes over approximately 500 rupees per month) are taxed 1% on their income and the total revenue generated used to give an equal percentage increase to all households in the lower ten percent income group (incomes less than 150 rupees per month approximately). This would result in an income increase of about 9% for these low income group groups. The average expenditure of income group 10 (1000-1499) would fall 0.316% while average expenditure of income group 1 (50-99) would rise 5.5%. This would result in a significant nutritional gain in all four nutrients assessed for the low income group with little impact on the nutrition of the high income group. Results are summarized in Table 1.4.

TABLE 1.4 EFFECT ON NUTRIENT INTAKE OF A 1% INCOME TRANSFER FROM THE UPPER TO THE LOWER 10% OF THE POPULATION

	Low income group 1	High income group 10
vegetable protein	+14.6%	-0.21%
animal protein	+ 9.8%	-0.34%
fat	+ 6.75%	-0.48%
calories	+13.9%	-0.34%

Significant improvement of this order warrants close analysis of how some such policy might be implemented. The effects of the tax incidence must be evaluated and a suitable means devised to effect the transfer. A direct food supplement would avoid the "leakage" which results from people buying higher priced varieties as income increases.

Conclusions and Some Implications

1. Nutrient intake is affected by household size, urban-rural location, job-status but primarily by food price and expenditure.

2. Nutrient intake increases with income but elasticities fall with income. As income rises vegetable/animal protein ratio falls.

3. Urban households have lower nutrient intake than rural households of the same size at the same income level. However this disadvantage is more than offset by typical income differentials. Rural incomes "on average" are about 2/3 of urban incomes.

4. The average food price index has a statistically significant negative coefficient. As indicated these price effects are quite complex and are treated in detail in Part II.

5. Even a small redistribution of income, i.e., taking 1% from upper income group, produces a major improvement in nutrition status.

6. While the expenditure elasticity for each nutrient is positive one must examine each nutrient for each income group; low income groups in particular show different responses for each nutrient.

7. Job status is significant for some groups. This may be because of supplies being more readily available as in the case of beef for farmers, who form the major portion of the self-employed population at all income groups but particularly at low income levels.

PART II - DEMAND FOR FOOD

Consumer Behavior

The conventional theory of consumer behavior is often based on assuming (or deriving from a set of assumptions) that individual consumers have a utility function $U(x)$, $U_i > 0$ with appropriate second order conditions so that one may solve the problem

$$\max_{x \geq 0} U(x) \quad \text{s.t.} \quad p'x \leq Y \qquad 2.1$$

where x is the bundle of goods at prices p and Y is income. One of the difficulties with this type of formulation is that it is extremely difficult to incorporate many empirically observed phenomena. Among these are the theory of conspicuous consumption as expounded by say Veblen or John Rae at an even earlier date.[16]

Veblen prophesies of the triumph of technocracy may not yet be fulfilled but there is considerable evidence that tastes and consumer demand are to some degree conditioned by such things as advertising and a 'keeping up with Joneses' syndrome. While one may disagree with some aspects of Galbraith's thesis, the ever increasing expenditures on Madison Avenue 'images' are sufficient

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[16] See Veblen, T., The Theory of the Leisure Class, New York, Macmillan, 1899 or John Rae, The Sociological Theory of Capital, London, The Macmillan Co., 1905. For a discussion of a number of these phenomena see Liebenstein, H., "Bandwagon, Snob and Veblen Effects in the Theory of Consumer's Demand," Quarterly Journal of Economics, May 1950. For a modern treatment of the evolution of consumption patterns towards a higher luxury good content see Taylor, L. and Bacha, E.L. "The Unequalizing Spiral: A First Growth Model for Belindia," Quarterly Journal of Economics (forthcoming).

evidence that advertising does succeed to some extent in conditioning peoples needs. In many underdeveloped countries the demonstration effect referred to by Ragnar Nurkse is self-evident. In Karachi, for example, in some maternity wards the representatives of some multinational corporations "sell" their baby foods to young mothers many of whom are semi-illiterate. The issue then arises, not whether these foods are good for the baby, but rather whether the limited resources of parents are being allocated efficiently when these relatively high priced nutrition components are included in their purchases.

To model some of these phenomena one would like to include quality effects in the utility function. Interpersonal effects would suggest including purchases of others in each person's utility function. Thus the price (or relative price) one pays might of itself have some utility.[17] The inclusion of a price in the utility function leads to some technical problems.[18]

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[17] One might also consider the Pigou effect or indeed any of the consumption functions where real wealth enters as an argument as being indicative of price parameters in the utility function; see Ando, A.K., and Modigliani, F., "The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests," American Economic Review, pp. 55-84, March 1963 and Pigou, A.C. "The Classical Stationary State," Economic Journal, pp. 343-351, December 1943.

[18] Consider the problem Max $U(x,p,Y)$, $p'x \leq Y$. One looses convexity

$$x \geq 0, p \geq p^*$$

so that without imposing further unrealistic assumptions one cannot obtain a solution. In Kalmans formulation he did not try to solve this problem but rather he optimized over only x. This yielded solutions of the form $x_i = f^i(p,y)$ in a neighborhood of $(\bar{p},\bar{y})$ which are unique and possess continuous first partials in this neighborhood. See Kalman, P.J., "Theory of Consumer Behavior when Prices Enter the Utility Function." Econometrica, Vol. 36, No. 3-4 (July-October, 1968).

Kalman introduced a price in his utility function formulation and established some theories to extend traditional theory. In a more recent paper[19] Chichilnisky and Kalman study the "local" properties of equilibria - without the convexity assumptions - for the less neoclassical agents.

The Model

The approach proposed in this analysis seeks to resolve some of these difficulties by considering consumer behavior to be essentially a two-step process. For each good there is a base price p_i*[20]. He can actually pay a price p_i which in general will be different from p_i*. This difference reflects these various quality, PTD (Processing, Transportation and Distribution), or snob values mentioned earlier. For convenience here it is termed the non-primary content ratio or quality $q = \frac{p_i}{p_i*}$.

Thus for each good i, (i = 1,...n) consumers expenditure k_i is allocated to yield maximum satisfaction or utility by an appropriate quantity-quality mix.

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[19] Chichilnisky, G. and Kalman, P.J., "Comparative Statics of Less Neoclassical Agents." Economics Department, Harvard University, March 1975. See also Debreu, G. "Economics with a Finite Set of Equilibria," Econometrica, 38, 1970.

[20] The base price actually chosen in this model is p_i* where p_i* is the price paid by the lowest income group. Without loss of generality one could also choose some other basis for p_i*. The consumer is however aware of the general price level for each good.

Step 1:

$$\text{Max } f^i(x_i, \frac{p_i}{p_i^*}) \qquad 2.2$$
$$x_i > 0$$
$$p_i \geq p_i^*$$
$$\text{s.t. } x_i p_i \leq k_i$$

In the second stage (not necessarily time phased) a customer allocates expenditure between goods so as to maximize his overall utility

Step 2.

$$\text{Max } U(f^1(k_1)^*, f^2(k_2)^*, \ldots f^n(k_n)^*) \qquad 2.3$$
$$k_i \geq 0$$
$$\text{s.t. } \Sigma k_i = Y$$

where the $f^i(k_i)^*$ are themselves the optimal outcome of the problem (2.2).

This two-step decomposition algorithm resolves many of the technical problems. Thus step 2 may now be solved for reasonable assumptions on U since the constraint is linear.

Let $L = U + \lambda(Y - \Sigma k_i)$ 2.4

First-order condition for a constrained maximum is

$$\frac{\delta L}{\delta k_i} = 0 \qquad i = 1, \ldots, n \qquad 2.5$$
$$\frac{\delta L}{\delta \lambda} = Y - \Sigma k_i = 0$$

Second-order condition is that d^2L be negative definite subject to the constraint

$$\Sigma dk_i = 0 \qquad 2.6$$

The system (2.5) can be solved for k_i if the conditions of the implicit function theorem are satisfied. From 2.5 one obtains n + 1 equations

$$g^i(z_1,\ldots,z_{n+2}) = 0 \qquad i = 1,\ldots,n+1 \qquad 2.7$$

where the n+2 arguments are $(k;Y,\lambda)$

Eqn. 2.7 can be solved for k_i in terms of Y if g^i and $\frac{\delta g^i}{\delta z_j}$ are continuous and the Jacobian, J, is non-zero, in the neighborhood of $\bar{k}$, $\bar{Y}$, $\bar{\lambda}$

$$J = \begin{vmatrix} g_1^1 & g_2^1 & \cdots & g_{n+1}^1 \\ & & & \\ g_1^{n+1} & & \cdots & g_{n+1}^{n+1} \end{vmatrix} \neq 0 \qquad 2.8$$

where g_j^i is $\frac{\delta g^i}{\delta z_j}$.

Hence one obtains a solution of the form

$$k_i = h^i(Y) \qquad i = 1,\ldots,n \qquad 2.9$$

It remains to consider step 1, Eqn. 2.2. Here the constraint is no longer convex but in view of the dimensionality of f^i this does not pose an insurmountable problem. The situation is illustrated in Fig. 2.1. The problem cannot of course be handled by a Kuhn-Tucker approach but nevertheless a sufficient condition for a solution to exist is that f^i be more strongly convex than the constraint function. So for each good one obtains a solution of the form.[21]

$$\begin{aligned} x_i &= r(k_i,p_i^*) \\ p_i &= s(k_i,p_i^*) \end{aligned} \qquad i = 1,\ldots,n \qquad 2.10$$

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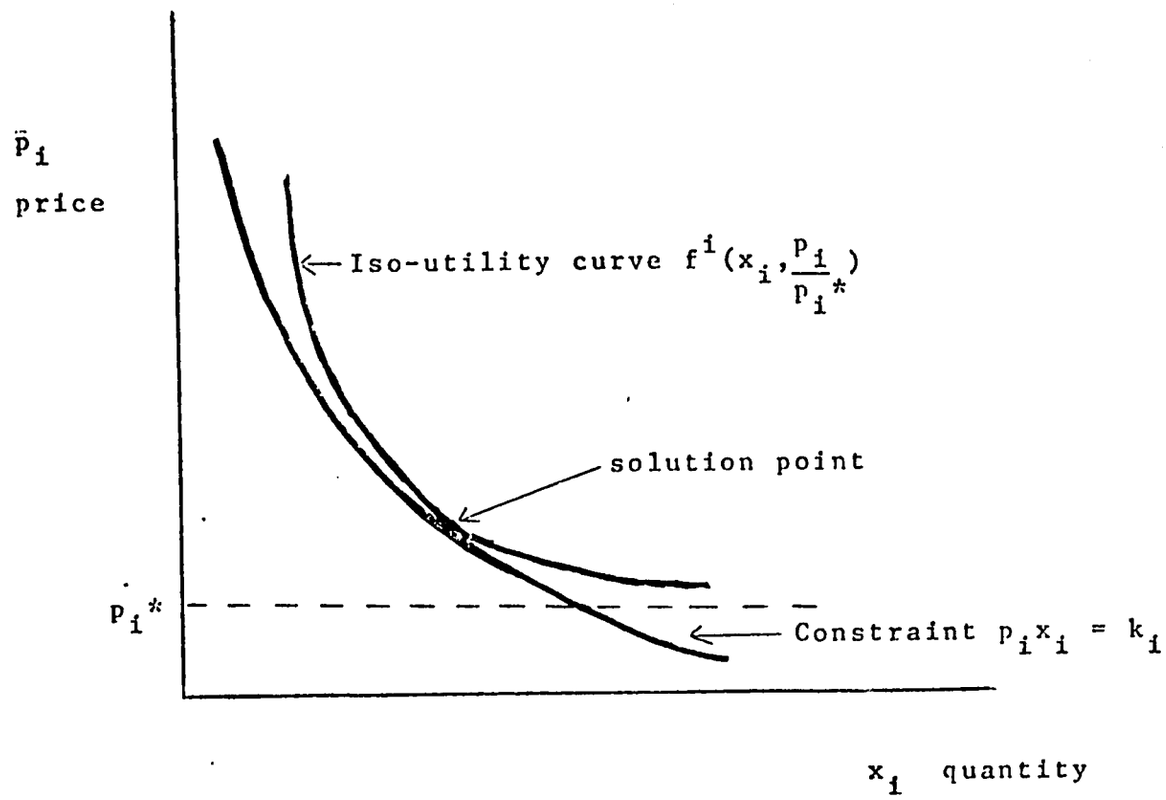
[21] There are some difficulties which may arise with corner solutions and concomitant continuity problems but these are not considered here. One possible class is

$$f_i(x_i, \frac{p_i}{p_i^*}) = \mu_i(p_i^*)\ (\log x_i)^{\alpha_i}(\log \frac{p_i}{p_i^*})^{\beta_i}$$

FIG. 2.1

CONSUMERS OPTIMUM FOR A SINGLE GOOD



Combining equations 2.9 and 2.10 one obtains

$$x_i = d^i(Y, p_i^*) \qquad 2.11$$

$$i = 1, \ldots, n$$

$$q_i = w^i(Y, p_i^*)$$

where $q_i = \frac{p_i}{p_i^*}$. There equations may be interpretted as follows. A typical consumer consumes a quantity x_i of good i with corresponding quality q_i when he has income Y and is faced by a general price level p_i^* for that good. The development of this model is of course premised on a number of assumptions. In particular the assumption of an "average" utility function is open to question. A practical solution requires some balance between a theory based on highly stylized assumptions and reality.

The actual equations estimated for x_i and q_i are adapted to try and reflect some of the individual differences between consumers. The model is given by

$$\log x_i = \alpha_{0i} + \alpha_{1i}\log E + \alpha_{2i}\log H + \alpha_{3i}D + \alpha_{4i}J + \alpha_{5i}\log p_i^* + \varepsilon_i$$

$$i = 1, \ldots, n \qquad 2.12$$

$$\log q_i = \beta_{0i} + \beta_{1i}\log E + \beta_{2i}\log H \pm \beta_{3i}D + \beta_{4i}J + \beta_{5i}\log p_i^* + \varepsilon_i$$

where x_i is quantity of good i consumed, E is expenditure/capita, H household size, p_i^* is price paid for good i by lowest income group, D is a dummy variable for urban (1) or rural (0) status, J gives job status, 1 for self-employed otherwise 0, while q_i is the quality of good i.

Discussion of Empirical Results

The model given in eqn. 2.12 was first estimated for all

income groups aggregated. A slightly modified[22] version was used for low, medium and high income groups and finally for urban and rural populations separately. The results for the aggregated regressions are given in Tables 2.1 and 2.2 while the other results are relegated to Appendix 4. The separate income group regressions suffer from a lack of sufficient observations so the standard errors in many instances are perhaps on the high side. In interpreting the results one must also be mindful that Pakistan is a developing country so that the markets and degree of participation, particularly in rural areas, are far from perfect.[23]

The food groupings, F_i, $i = 1,\ldots,11$ are chosen because these are the foods which dominate the Pakistan diet for protein-calorie intake. One must make the usual compromise between too much detail and overpowering volumes of data on the one hand and highly aggregated but less informative grouping on the other. The grouping chosen follows fairly closely that used by the Government of Pakistan in carrying out its household survey. In view of the importance of cereals it would be desirable for future work to try and disaggregate further the F1, wheat, and F2, rice groups.

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[22] The modification for separate income groups was to omit the J variable to try and increase the statistical stability of the estimates where the dearth of data created some difficulty while for the urban and rural regressions the dummy variable D was of course omitted.

[23] For a discussion of these and other imperfections see Eckaus, R.S., "The Factor Proportions Problem in Underdeveloped Areas," American Economic Review, pp. 539-565, September 1955.

TABLE NO. 2.1 ALL INCOME GROUPS - QUANTITY

regressions of the log of quantity of various food groups consumed

	FOOD										
	wheat F1	rice F2	pulse F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	3.2 (.35)	-.57 (.55)	-.17 (.28)	1.5 (.59)	1.3 (2.3)	2.0 (.66)	-2.5 (2.7)	.89 (1.3)	-.86 (.57)	1.10 (.23)	1.96 (.31)
EL	.08 (.08)	.29 (.24)	.28 (.10	.92 (.17)	1.6 (1.0)	1.3 (.21)	-.38 (.9)	2.6 (.47)	.41 (.22)	.38 (.09)	.74 (.12)
HL	-.12 (.05)	.60 (.12)	.006 (.06)	.52 (.11)	.05 (.5)	.03 (.13)	.67 (.5)	.66 (.26)	.26 (.13)	-.05 (.05)	-.26 (.07)
D	-.19 (.04)	-.15 (.05)	.009 (.03)	-.17 (.06)	-2.9 (.2)	-1.2 (.08)	1.2 (.3)	.48 (.12)	.42 (.05)	-.005 (.027)	-.28 (.03)
J	.01 (.07)	.14 (.20)	.17 (.08)	.25 (.13)	-1.1 (.9)	-.4 (.16)	.08 (.66)	.29 (.37)	.31 (.18)	.04 (.07)	-.10 (.09)
P_i *	.29 (.23)	-.24 (.10)	-.22 (.11)	-.67 (.27)	-.3 (.1)	-.85 (.37)	-1.6 (2.0)	-.07 (.58)	-.44 (.21)	.3 (.15)	-.13 (.02)

See Appendix 1 for complete variable list.

TABLE NO. 2.2 ALL INCOME GROUPS - QUALITY

regressions of the log of quality of various food groups consumed

	FOOD										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	-.64 (.24)	.12 (.46)	.007 (.48)	-.1 (.43)	3.0 (1.5)	2.3 (.25)	3.0 (2.6)	.84 (.42)	.05 (.37)	-.71 (.40)	.05 (.31)
EL	.10 (.06)	.25 (.16)	-.04 (.15)	.22 (.13)	.99 (.69)	.25 (.11)	.89 (.8)	.11 (.14)	-.04 (.14)	.19 (.13)	.32 (.11)
HL	.004 (.04)	.12 (.10)	-.02 (1.0)	.01 (.08)	-.05 (.31)	-.057 (.06)	-.99 (.5)	.11 (.08)	.16 (.09)	.14 (.08)	.28 (.07)
D	.02 (.02)	.15 (.05)	.02 (.06)	.33 (.04)	.31 (.11	.04 (.02)	-.13 (.3)	.11 (.05)	.06 (.04)	.29 (.06)	.21 (.04)
J	-.02 (.05)	.03 (.12)	-.2 (.11)	.05 (.11)	.86 (.60)	.11 (.09)	.05 (.6)	-.02 (.10)	-.09 (.11)	-.004 (.1	.07 (.08)
P_i^*	-.82 (.16)	-.57 (.13)	-.82 (.29)	-.68 (.18)	-.81 (.07)	-1.1 (.09)	.9 (1.9)	-.6 (.24)	-.5 (.17)	-2.0 (.37)	-.97 (.02)

See Appendix 1 for complete variable list.

One can obtain an overall view of the situation from Tables 2.1 and 2.2. Here one notices the expenditure elasticities for most foods are positive which is not really too surprising. However, on examining Table 2.2 one finds a less obvious outcome; that as expenditure rises in many instances consumers are willing to pay more for the same quantity. What this says is that as income and hence expenditure rise households tend to buy higher priced varieties. The implication of this phenomenum is that if one is interested in improving nutritional intake as measured by food quantities, then one should be aware of significant "leakage" between the increase in income and the increase in nutrient intake.

The results are now discussed in more detail first for quantity and then quality of food.

Quantity Regressions

1. Expenditure Effect (EL)

As might be expected from the nutrition results of Part I, expenditure (and hence income) is a significant determinant of the quantity of food entering the consumers bundle. For ten of the food groups the expenditure elasticity, η_e, is positive. The exception vegetable ghee (F7), is negative but N.S.S. This may be attributed in part to severe shortages of that food. In recent years it has been subject to strict rationing. For three groups, butter, ghee and mutton, F5, F6 and F8 the value of η_e is greater than one indicating that these are luxury goods. For the low income group 1, Table A4.1, one finds many more foods viewed as

luxuries - the expenditure elasticity for even wheat being S.S. greater than one! To appreciate some of the variation across income groups the expenditure elasticities for two foods, wheat, F1 (a staple) and ghee, F6 (a luxury) are given in Table 2.3.

TABLE 2.3

EXPENDITURE ELASTICITY OF DEMAND BY INCOME GROUP

	Income Group			
Food	Low	Middle	High	All Groups
wheat	2.8	.37	-.65	.08
ghee	3.7	3.2	3.4	1.3

2. Household Size (HL)

The effect of household size on quantity consumed again follows a fairly distinct pattern, Table 2.1. For most foods the effect is small but for luxury goods, F5 and F6 it is negligible and for F11, negative. This indicates that larger households tend to have a consumption pattern higher in the quantity of luxury goods.

3. Urban-Rural Status (D)

The most significant differences between urban and rural household consumption occurs for butter, F5 and ghee F6 where the urban population consumes S.S. less and for vegetable ghee where it consumes S.S. more. The differences may in part be attributed to marketing problems and transportation costs; as butter and ghee are more readily available in rural areas while

vegetable ghee, largely imported, is more readily available in urban areas.

4. Job Status (J)

The results for job-status are not particularly illuminating. The self-employed are largely farmers and even more so among low income groups. The results do not contribute much more than already observed in Part I for nutrition demand. The self-employed consume more pulses, milk and beef.

5. Price (P_i^*)

Nine price elasticities, η_p, were negative, Table 2.1, S.S. for luxuries F5, F6 and also for milk, F4 and beef F9. However, if one examines the income group specific regressions one finds that while the value of η_p is negative at low income for pulses and rice it becomes positive for the middle and high income groups, Tables A4.1, A4.3, A4.5. This would indicate that the quantity of these goods purchased by the higher income groups is not affected negatively by price.

Quality Regressions

1. Expenditure Effect (EL)

Once more the aggregate picture is conveyed by Table 2.2 The expenditure elasticity of demand for quality, μ_e, is either negligible or positive! The value of μ_e is positive for the luxuries F5 and F6 and also for the sugar group F11. This implies that as consumer income rises there is a strong tendency not only to buy more but also to buy higher priced varieties.

2. Household Effect (HL)

The effect of household size is rather mixed. For most

food groups the household size coefficient is positive; the exceptions being F3, F5, F6 and vegetable ghee, F7. The latter is probably due to the strong role played by the government in maintaining a uniform price. Thus one is led to believe that as household size increases members tend to alter their consumption pattern of some foods. This pattern tends to hold across income groups and for some foods the effect is stronger among low income groups.

TABLE 2.4

REGRESSION COEFFICIENT OF HOUSEHOLD SIZE IN THE DEMAND FOR QUALITY IN PULSES CONSUMPTION

Income Group			
Low	Middle	High	All Groups
.61	-.16	-1.2	-.02

3. Urban-Rural Status (D)

The results indicate what one might expect intuitively. For ten of the food groups there are positive coefficients. This one might attribute to the more numerous varieties available in urban areas. Also one expects a broader spectrum of P.T.D. or non-primary components in urban areas. However advertising media, such as television which is particularly popular in Pakistan among the small urban populace wealthy enough to afford it, and radio, exert their greatest efforts in urban areas.

4. Job Status (D)

Again the results are not too brilliant for this variable. The self-employed again reflecting their bucolic content show preference for the dairy products F5 and F6.

5. Price (p_i^*)

The price elasticities of the demand for quality, μ_p, display an intuitively reassuring pattern. In ten instances these are negative and S.S.! The exception once more is vegetable ghee due to limited variety availability. The price elasticities for quality do not show a uniform pattern for all foods across income groups but for a number of them one may observe that as income rises the μ_p becomes first more negative and then less so. This would indicate that as the general price for these food groups rises the <u>middle class tends to change more than other income groups</u> towards varieties at lower prices than it customarily consumes.

TABLE 2.5

PRICE ELASTICITY FOR DEMAND FOR <u>QUALITY</u>

IN VARIOUS FOODS ACROSS INCOME GROUPS

	Income Group			
	Low	Middle	High	All Groups
Rice(F2)	-.56 (.42)	-1.05 (.14)	-.72 (.46)	-.57 (.13)
Milk(F4)	-.68 (.18)	-1.3 (.1)	-.9 (.8)	-.68 (.18)

Conclusions and Possible Strategies

The primary conclusion of this analysis of the demand for food is that quality plays an important role. Not only should one analyze the quantity of various foods which enter a consumer's bundle but also the quality combination chosen. The general pattern that emerges is

(i) as income increases people consume more but much of the increase goes to buying higher priced varieties;

(ii) as household size increases consumption of higher priced varieties increases;

(iii) urban dwellers are more prone to purchase higher priced varieties;

(iv) as price levels rise the quantity consumed falls, but an even stronger effect is the degree to which people switch to lower priced varieties.

The issue then arises of what policy implications are suggested. At one extreme (very extreme) a nutritionally aware benevolent dictator looking at these results could conclude that significant improvement in nutritional status may be achieved by limiting the available quality range to the lower priced varieties. In many centrally planned economies[24] the government

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[24] For an interesting report of how some of these issues were addressed by one centrally planned economy see Wray, J.D., "Health and Nutritional Factors in Early Childhood Development in the People's Republic of China," Ramathibodi Community Health Program, Bangkok Rockfeller Foundation Field Staff.

the available range of qualities of various foods to en-
at the broad mass of the population is first adequately
ed before catering to those tastes which may involve a
cation of resources.

here funds are not readily available to supplement in-
r better still food intake, (to avoid the leakage effect
cated by positive quality expenditure elasticities) a
ent should consider programs to modify tastes. These
s might take two general forms.

i) Education: This would mean seeking to make the public aware of what food combinations might best serve their nutritional needs at various cost levels. The program could be directed at both the supply and demand side. Demand could be handled by advertising while on the supply side processors could assist in making available all nutrition information on their products. The latter approach is being currently adopted in the United States for many foods.

) Taxation: A slightly stronger approach would be to devise an appropriate tax scheme which would discourage consumption of those high priced goods with relatively low nutrient content. Such a program would need to give adequate consideration to transient and general equilibrium effects as the nutritionally undesirable

varieties might for example have a high labor content.

Modifying tastes does seem to offer some opportunity for improving nutritional status in countries whose limited resources might not be easily wooed in that direction. The problem is of course an extremely difficult one. Some strong centrally controlled governments have had some success but in a mixed economy a realistic program should probably rely more heavily on a suitably designed tax program in trying to change deeply imbedded traditions.

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APPENDIX 1

Variables

All quantities are in seers per month per capita, all incomes and expenditures are in rupees per month per capita unless otherwise stated.

1 seer = 933.1 grams = 2.06 pounds (lb.)

Rs. 9.90 = U.S. $1.00 (effective February 1973)

In the regressions the natural logarithm of variables is used with appropriate normalization and this is indicated by adding L to variable name.

P_i	imputed price for good i in rupees/seer
P_i^*	price for good i paid by the lowest income group
q_i	quality for good i
FI	food price index (FAO)
DEF	cost of living index (FAO)
E_i	expenditure on good i
E	total expenditure
EH	household expenditure
Y	income
C	constant in regression
H	average number of members per household
n_i	number of sample households in income group i
DL	dummy variable = 1 urban, = 0 rural
JL	dummy variable = 1 self-employed, - 0 otherwise

Food Groups

F1	wheat and wheat flour
F2	rice and rice flour
F3	pulses

F4 milk (fresh and boiled)

F5 butter

F6 ghee

F7 edible oils including vegetable ghee and mustard oil

F8 mutton

F9 beef and fish

F10 vegetables including potato and onion*

F11 gur, sugar cane products, honey and sugar preparations

Income Groups

Y1 50-99

Y2 100-149

Y3 150-199

Y4 200-249

Y5 250-299

Y6 300-399

Y7 400-499

Y8 500-749

Y9 750-999

Y10 1000-1499

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* Quantity data was available on only the potato and onion components of this group and so the imputed price should be augmented to reflect the other components.

Nutrients

N1 PV vegetable protein in grams per capita per month

N2 PA animal protein in grams per capita per month

N3 FAT - fat in grams per capita per month

N4 CA - calories per capita per month

T Transformation matrix to convert a vector of food quantities F to a vector of nutrient quantities N

APPENDIX 2

Correction for concavity of the log function.

The problem is to estimate $\overline{\log x}$ and when $\log \bar{x}$ is available for some class interval.

For group X_1 to X_{i+1} let $\bar{x}$ be the mean of n observations $x_1, x_2, \ldots, x_n$. Then

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \quad \text{and} \qquad \text{A1}$$

$$\log \bar{x} = \log \left(\frac{1}{n} \sum_{i=1}^{n} x_i\right) \qquad \text{A2}$$

But

$$\overline{\log x} = \frac{1}{n} \sum_{i=1}^{n} \log x_i = \frac{1}{n} \log\left(\prod_{i=1}^{n} x_i\right)$$

$$= \frac{1}{n} \log\left(\prod_{i=1}^{n} (\bar{x} + \Delta x_i)\right) \qquad \text{A3}$$

where Δx_i is the deviation of the x_i from the arithmetic mean $\bar{x}$. Equation A3 may now be written in the form

$$\overline{\log x} = \frac{1}{n} \log \left((\bar{x})^n \prod_{i=1}^{n} \left(1 + \frac{\Delta x_i}{\bar{x}}\right)\right)$$

$$= \log \bar{x} + \delta$$

The term δ will always be non positive and except for the case where $x_i = 0$ for all i, will be strictly negative. Thus $\log \bar{x}$ overestimates $\overline{\log x}$ except when all $x_i = \bar{x}$. An approximation is now obtained for the error δ.

$$\delta = \frac{1}{n} \log \prod_{i=1}^{n} (1 + \frac{\Delta x_i}{x})$$

$$= \frac{1}{n} \log (1 + \frac{1}{\bar{x}} \sum_{i=1}^{n} \Delta x_i + \frac{1}{\bar{x}^2} \sum_{i=1}^{n} \sum_{j=1}^{n} \Delta x_i \Delta x_j +$$

higher order terms)

$$= \frac{1}{n} \log (1 + \frac{1}{\bar{x}^2} (\sum_{i=1}^{n} \sum_{j=1}^{n} \Delta x_i \Delta x_j - \sum_{i=1}^{n} \Delta x_i^2) + \text{h.o.t.})$$

$$= \frac{1}{n} \log (1 - \frac{n \text{ var } x_i}{\bar{x}^2} + \text{h.o.t.})$$

If $\frac{n \text{ var } x_i}{\bar{x}^2} << 1$, then δ is given by

$$\delta = \frac{\text{var } x_i}{\bar{x}^2}$$

Since only information on $\bar{x}$ is available it remains to estimate var x_i. If the x_i values are assumed uniformly distributed over the range of values Δ then var x_i is given by, Sheppard's correction, $\frac{\Delta^2}{12}$ and the appropriate correction to log $\bar{x}$ is $= - \frac{\Delta^2}{12\bar{x}^2}$. A somewhat more sophisticated estimate may be obtained by fitting a curve to values for $\bar{x}$ in the intervals X_{i-1} to X_i, X_i to X_{i+1} and X_{i+1} toX_{i+2}. This would yield an estimate for the range Δ in the interval X_i to X_{i+1}. It would also give an improvement on the uniform distribution assumption. The correction becomes significant whenever $\frac{\Delta^2}{12\bar{x}^2}$ is significant compared to log $\bar{x}$. For typical estimates of log H this correction amounts to 2% to 3%.

APPENDIX 3

DISAGGREGATED REGRESSIONS FOR NUTRITION

TABLE A3.1 ALL INCOME GROUPS

Regression Coefficients For Log Of Nutrient Intake

On The Log Of Different Variables

Coefficients of	NUTRIENT PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	8.48 (.36)	7.98 (.63)	11.02 (1.44)	12.67 (.36)	7.25 (.0076)	5.57 (.014)	6.85 (.03)	11.0 (.008)
EHL	.023 (.054)	.81 (.095)	.38 (.22)	.19 (.055)	-.0068 (.01)	.48 (.019)	.38 (.041)	.082 (.011)
DL	-.13 (.011)	-.02 (.02)	-.027 (.046)	-.14 (.012)	-.13 (.0096)	.025 (.018)	-.027 (.038)	-.12 (.010)
HL	-.048 (.089)	-.55 (.15)	.009 (.35)	-.17 (.089)				
FIL	-.23 (.073)	-.29 (.13)	-.84 (.29)	-.27 (.073)				
R^2	.999	.999	.997	.999	.999	.999	.997	.999

See Appendix 1 for variable list.

TABLE A3.2 LOW INCOME GROUP 1 (50-99)

Regression Coefficients For Log of Nutrient Intake

Coefficients of	NUTRIENT PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	13.38 (1.65)	14.11 (2.90)	13.56 (9.16)	16.85 (1.80)	7.82 (.24)	5.85 (.29)	7.89 (.51)	11.42 (.25)
EHL	2.65 (.52)	1.78 (.91)	1.23 (2.87)	2.53 (.56)	.66 (.27)	.86 (.32)	.54 (.57)	.53 (.28)
DL	-.11 (.033)	.032 (.058)	-.13 (.18)	-.12 (.036)	-.012 (.039)	.17 (.047)	-.022 (.082)	-.027 (.04)
HL	-2.2 (.47)	-1.88 (.83)	-1.45 (2.63)	-2.2 (.52)				
FIL	-.24 (.29)	-1.06 (.51)	-.84 (1.60)	-.21 (.31)				
R^2	.999	.999	.997	1.000	.999	.998	.996	.999

See Appendix 1 for variable list.

TABLE A3.3 MIDDLE-INCOME GROUPS (250-299)

Regression Coefficients For Log of Nutrient Intake

Coefficients of	NUTRIENT PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	8.07 (2.11)	9.95 (2.87)	-1.42 (9.03)	10.40 (1.94)	7.25 (.057)	5.50 (.073)	6.38 (.14)	10.97 (.044)
EHL	.98 (.65)	1.22 (.89)	4.17 (2.79)	1.48 (.60)	.14 (.35)	1.20 (.44)	3.02 (.83)	.58 (.27)
DL	-.24 (.063)	-.19 (.085)	.50 (.27)	-.14 (.057)	-.14 (.039)	.0001 (.05)	.25 (.093)	-.095 (.03)
HL	-1.56 (.50)	-1.83 (.68)	1.49 (2.14)	-1.07 (.46)				
FIL	.41 (.41)	-.20 (.56)	.97 (1.75)	.50 (.38)				
R^2	.999	.999	.998	1.000	.999	.998	.997	.999

See Appendix 1 for variable list.

TABLE A3.4 HIGH INCOME GROUP 10 (1000-1499)

Regression Coefficients For Log of Nutrient Intake

Coefficients of	NUTRIENT PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	4.22 (2.71)	6.78 (4.62)	14.06 (1.53)	6.78 (4.6)	6.94 (.47)	5.27 (.89)	5.18 (.94)	10.3 (.36)
EHL	.66 (.51)	1.05 (.86)	1.53 (.29)	1.05 (.86)	.41 (.40)	.83 (.76)	1.88 (.805)	.86 (.30)
DL	-.32 (.10)	-.16 (.18)	.052 (.059)	-.016 (.18)	-.31 (.09)	.057 (.17)	.12 (.18)	-.23 (.068)
HL	-.38 (.52)	-.96 (.89)	-.18 (.30)	-.96 (.90)				
FIL	.66 (.62)	.066 (1.1)	-1.63 (.35)	.066 (1.06)				
R^2	.999	.999	.999	.999	.999	.999	.999	.999

See Appendix 1 for variable list.

TABLE A3.5 URBAN - ALL INCOME GROUPS

Regression Coefficients For Log of Nutrient Intake

Coefficient of	NUTRIENT PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	8.02 (.33)	8.32 (.52)	13.64 (1.98)	12.83 (.39)	7.12 (.0043)	5.60 (.0095)	6.83 (.027)	10.9 (.006)
EHL	.0098 (.046)	.86 (.072)	.31 (.28)	.18 (.055)	-.05 (.0094)	.42 (.021)	.40 (.06)	.049 (.013)
HL	-.10 (.078)	-.75 (.12)	.16 (.46)	-.22 (.092)				
FIL	-.15 (.067)	-.29 (.10)	-1.43 (.40)	-.31 (.079)				
R^2	.999	.999	.996	.999	.999	.999	.994	.999

See Appendix 1 for variable list.

TABLE A3.6 RURAL - ALL INCOME GROUPS

Regression Coefficients For Log of Nutrient Intake

Coefficients of	NUTRIENT PVL	PAL	FATL	CAL	PVL	PAL	FATL	CAL
C	9.47 (.33)	7.93 (.96)	6.75 (1.99)	12.57 (.43)	7.27 (.0065)	5.59 (.014)	6.85 (0.25)	11.05 (.0069)
EHL	.36 (.064)	1.08 (.19)	.49 (.39)	.46 (.084)	.076 (.014)	.57 (.03)	.34 (.055)	.145 (.015)
HL	-.44 (.098)	-.78 (.29)	-.22 (.59)	-.49 (.13)				
FIL	-.28 (.067)	-.19 (.19)	.10 (.40)	-.13 (.087)				
R^2	1.000	.999	.998	1.000	.999	.999	.998	.999

See Appendix 1 for variable list.

APPENDIX 4

DISAGGREGATED REGRESSIONS FOR THE DEMAND FOR FOOD

TABLE NO. A4.1 LOW INCOME GROUP (50-99)

	FOOD - QUANTITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	8.0 (1.4)	-1.86 (7.5)	4.0 (5.0)	-1.9 (.37)	-18.3 (3.4)	1.05 (1.1)	9.1 (31.7)	-38.7 (69.9)	8.8 (3.1)	-2.0 (1.1)	.83 (4.4)
EL	2.8 (.66)	-.50 (3.6)	2.7 (2.5)	-.80 (.16)	-6.7 (1.6)	3.7 (.54)	5.0 (14.3)	-13.2 (30.5)	3.7 (1.6)	-1.4 (.59)	.99 (1.9)
HL	.62 (.18)	.05 (1.2)	.35 (.68)	.33 (.04)	1.3 (.2)	3.2 (.2)	-.47 (2.7)	5.5 (5.1)	-3.4 (1.3)	-.42 (.15)	.63 (.78)
D	-.13 (.05)	-.11 (.24)	-.02 (.13)	0 (.01)	-2.0 (.07)	-1.2 (.03)	.30 (.58)	.96 (.9)	.30 (.08)	-.05 (.03)	-.02 (.16)
P_i^*	.37 (.33)	-.42 (.44)	-.78 (.82)	-.73 (.04)	.08 (.05)	1.2 (.17)	.38 (5.2)	2.8 (7.5)	-4.0 (1.1)	.48 (.21)	-.78 (.23)

See Appendix 1 for complete variable list.

TABLE A4.2 LOW INCOME GROUP (50-99)

FOOD - QUALITY

	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	-4.9 (2.1)	2.1 (7.2)	4.4 (6.6)	1.03 (2.4)	-40 (36)	9.2 (4.8)	6.3 (26.9)	2.0 (5.7)	-3.3 (3.3)	6.5 (2.3)	-1.5 (3.7)
EL	-1.86 (1.00)	1.9 (3.4)	2.0 (3.3)	.64 (1.0)	-18 (16.9)	3.4 (2.3)	1.5 (12.1)	.53 (2.5)	-2.0 (1.7)	3.3 (1.2)	-.77 (1.6)
HL	.11 (.27)	1.4 (1.2)	.61 (.90)	-.09 (.26)	1.9 (2.3)	-.68 (.86)	-1.1 (2.3)	-.47 (.4)	-.43 (1.4)	-.50 (.3)	.04 (.66)
D	.11 (.08)	.16 (.23)	-.14 (.18)	.18 (.08)	.77 (.7)	-.37 (.12)	.09 (.5)	.05 (.07)	-.06 (.08)	.036 (.07)	.11 (.13)
P_i^*	-.88 (.50)	-.56 (.42)	.68 (1.1)	-.57 (.29)	-.06 (.5)	-.63 (.7)	-2.1 (4.4)	-.10 (.6)	-.5 (1.1)	-1.97 (.43)	-.36 (.20)

See Appendix 1 for complete variable list.

TABLE NO. A4.3 MIDDLE INCOME GROUP (250-299)

	FOOD - QUANTITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	5.3 (1.2)	3.05 (2.3)	2.7 (1.6)	4.6 (1.1)	5.5 (3.5)	-1.34 (7.1)	-25.7 (9.7)	-1.4 (2.1)	5.3 (2.3)	.61 (1.1)	2.1 (.91)
EL	.37 (.39)	-1.0 (.92)	1.2 (.41)	.56 (.30)	-1.9 (.85)	3.2 (2.2)	1.1 (2.3)	5.1 (.5)	3.0 (1.1)	.19 (.4)	.81 (.48)
HL	-1.1 (.62)	-2.3 (1.2)	-.57 (.75)	-.94 (.54)	-5.6 (1.8)	3.4 (4.0)	13.2 (4.5)	3.8 (1.1)	-.35 (1.5)	.08 (.5)	-.31 (.64)
D	-.29 (.08)	-.43 (.13)	-.11 (.09)	-.58 (.06)	-3.0 (.2)	-.95 (.36)	2.7 (.51)	.82 (.1)	.09 (.13)	.04 (.06)	-.29 (.07)
P_i^*	0 (.4)	.16 (.23)	.19 (.22)	.07 (.17)	-.23 (.06)	-.69 (1.2)	1.0 (2.3)	1.0 (.3)	.6 (.6)	.48 (.34)	-.20 (.09)

See Appendix 1 for complete variable list.

TABLE A4.4 MIDDLE INCOME GROUP (250-299)

	FOOD - QUALITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	-2.5 (.9)	.98 (1.4)	-.66 (5.6)	-1.1 (.6)	8.2 (11.0)	.09 (1.6)	17.7 (10.6)	2.8 (2.2)	-.72 (1.7)	-.24 (2.2)	-1.3 (1.99)
EL	.72 (.27)	3.3 (.55)	-.49 (1.5)	.8 (.2)	-.94 (2.7)	1.4 (.49)	-3.2 (2.5)	-1.2 (.5)	-3.3 (.8)	-1.9 (.8)	.90 (1.0)
HL	1.3 (.44)	2.2 (.7)	-.16 (2.7)	.7 (.3)	-4.4 (5.7)	1.8 (.90)	-11.3 (4.9)	-2.0 (1.2)	-2.8 (1.1)	-1.7 (1.0)	1.65 (1.4)
D	.18 (.06)	.35 (.08)	.05 (.32)	.5 (.04)	-.32 (.62)	.06 (.08)	-1.0 (.55)	-.03 (.11)	.09 (.10)	.11 (.13)	.37 (.15)
P_i^*	-1.3 (.3)	-1.05 (.14)	-1.1 (.77)	-1.3 (.1)	-.96 (.19)	-.36 (.27)	-2.4 (2.5)	-1.2 (.34)	-2.1 (.4)	-1.1 (.7)	-.57 (.19)

See Appendix 1 for complete variable list.

TABLE NO. A4.5 HIGH INCOME GROUP (1000 - 1499)

	FOOD - QUANTITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	4.3 (1.8)	-2.3 (4.3)	.73 (.78)	2.5 (1.0)	6.4 (1.5)	-2.4 (1.3)	-32.8 (12.6)	-.06 (2.9)	-1.6 (9.0)	-.11 (2.1)	.46 (.90)
EL	-.65 (.68)	2.4 (2.3)	.91 (.38)	.37 (.4)	1.4 (.7)	3.4 (.6)	3.5 (2.0)	1.7 (1.2)	3.6 (3.8)	.95 (1.3)	.62 (.57)
HL	-.31 (.68)	2.9 (2.4)	.16 (.45)	-.04 (.5)	-2.7 (.92)	4.6 (.9)	10.4 (3.7)	.08 (1.5)	2.3 (4.6)	1.1 (1.1)	.58 (.55)
D	-.56 (.20)	-.07 (.45)	-.37 (.09)	-.3 (.1)	-1.7 (.16)	.48 (.20)	.13 (.95)	.25 (.31)	.54 (1.0)	-.36 (.4)	-.72 (.11)
P_i^*	1.4 (1.2)	.83 (1.0)	.57 (.28)	-.2 (.3)	-.16 (.08)	-4.6 (.7)	18.8 (8.9)	1.7 (1.6)	2.1 (3.3)	.97 (2.7)	-.025 (.17)

See Appendix 1 for complete variable list.

TABLE A4.6 HIGH INCOME GROUP (1000-1499)

	FOOD - QUALITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	-1.1 (1.2)	2.2 (1.9)	1.55 (.65)	1.1 (2.3)	2.5 (.64)	4.3 (.7)	10.5 (12.9)	.34 (.94)	1.5 (1.2)	-.22 2.9	1.9 (.4)
EL	.7 (.48)	-.43 (1.0)	-.97 (.32)	-.4 (.9)	-.14 (.31)	-1.1 (.3)	-2.4 (2.1)	-.74 (.4)	.16 (.50)	-.03 (1.9)	-.13 (.28)
HL	.45 (.48)	-1.2 (1.1)	-1.2 (.37)	-1.0 (1.1)	-.50 (.38)	-2.0 (.48)	-4.0 (3.8)	-.19 (.5)	-.32 (.60)	-.77 (1.6)	-.71 (.27)
D	-.15 (.15)	.07 (.21)	-.08 (.08)	.4 (.23)	.16 (.07)	-.26 (.10)	.36 (.98)	.02 (.10)	-.03 (.13)	.76 (.56)	.21 (.05)
P_i^*	-1.1 (.85)	-.72 (.46)	-1.3 (.2)	-.9 (.8)	-1.0 (.03)	-.39 (.38)	-6.0 (9.1)	-.17 (.5)	-.17 (.42)	-3.4 (3.7)	-.52 (.08)

See Appendix 1 for complete variable list.

TABLE A4.7 URBAN POPULATION - ALL INCOMES

FOOD - QUANTITY

	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetables F10	sugar F11
C	2.7 (.2)	-.08 (.39)	-.28 (.30)	2.2 (.27)	-.97 (3.1)	1.57 (.87)	.29 (3.8)	1.7 (1.3)	-.52 (.63)	1.17 (.26)	1.1 (.3)
EL	-.03 (.05)	.43 (.13)	.10 (.10)	.8 (.07)	2.5 (1.1)	1.44 (.28)	-.31 (.76)	2.3 (.34)	.14 (.21)	.29 (.08)	.58 (.1)
HL	-.15 (.04)	.32 (.10)	-.064 (.08)	.14 (.06)	.7 (.81)	.42 (.22)	1.2 (.61)	.78 (.28)	.06 (.16)	-.06 (.06)	-.08 (.08)
P_i^*	.06 (.12)	-.33 (.07)	-.12 (.14)	-.28 (.11)	-.5 (.16)	-1.9 (.49)	-4.7 (3.6)	-1.4 (1.0)	-.31 (.26)	.65 (.27)	.01 (.02)

See Appendix 1 for complete variable list.

TABLE A4.8 URBAN POPULATION - ALL INCOMES

	FOOD - QUALITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	-.46 (.28)	.70 (.51)	.20 (.52)	-.7 (.3)	3.6 (2.1)	2.1 (.27)	.59 (4.4)	.54 (.53)	-.06 (.48)	-1.75 (.27)	.41 (.36)
EL	.11 (.06)	.36 (.16)	.18 (.17)	.07 (.07)	.6 (.7)	.09 (.10)	.76 (.83)	.03 (.13)	.04 (.16)	.14 (.08)	.34 (.14)
HL	.01 (.05)	.04 (.13)	-.05 (.12)	.16 (.06)	-.68 (.53)	-.06 (.07)	-1.3 (.68)	.16 (.11)	.33 (.13)	.31 (.06)	.22 (.09)
P_i^*	-.66 (.19)	-.47 (.15)	-1.3 (.38)	-1.1 (.12)	-.67 (.10)	-1.1 (.1)	4.3 (4.4)	-.4 (.4)	-.67 (.22)	-3.8 (.23)	-.98 (.02)

See Appendix 1 for complete variable list.

TABLE A4.9 RURAL POPULATION - ALL INCOMES

FOOD - QUANTITY

	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	3.8 (.3)	-.24 (1.2)	.27 (.57)	.29 (.9)	-.49 (1.1)	.3 (.77)	-4.9 (5.2)	2.7 (1.8)	.34 (1.1)	2.1 (.43)	2.5 (.4)
EL	.34 (.10)	.05 (.43)	.37 (.16)	.87 (.27)	1.1 (.36)	1.4 (.2)	-1.4 (1.4)	3.1 (.59)	.56 (.35)	.80 (.16)	1.1 (.15)
HL	-.07 (.06)	.40 (.29)	-.22 (.11)	.68 (.18)	.26 (.25)	.21 (.16)	.5 (1.1)	-.09 (.40)	-.24 (.26)	-.37 (.10)	-.22 (.11)
P_i^*	.44 (.23)	.07 (.21)	-.49 (.36)	-1.5 (.37)	-.04 (.04)	.55 (.45)	-.7 (3.2)	.73 (.43)	-.61 (.48)	-.20 (.18)	-.08 (.04)

See Appendix 1 for complete variable list.

TABLE A4.10 RURAL POPULATION - ALL INCOMES

	FOOD - QUALITY										
	wheat F1	rice F2	pulses F3	milk F4	butter F5	ghee F6	v. ghee F7	mutton F8	beef F9	vegetable F10	sugar F11
C	-.75 (.38)	-2.1 (.69)	.72 (.66)	1.6 (.67)	2.2 (.7)	2.0 (.4)	6.5 (5.1)	1.9 (.73)	-.21 (.51)	-1.0 (.56)	.38 (.41)
EL	.24 (.10)	.06 (.22)	.14 (.5)	.33 (.20)	.38 (.22)	.02 (.12)	1.6 (1.4)	.25 (.22)	-.19 (.17)	-.15 (.19)	.38 (.15)
HL	-.09 (.07)	.29 (.14)	.25 (1.2)	-.33 (.13)	-.01 (.16)	.08 (.09)	-1.7 (1.1)	-.06 (.17)	.24 (.12)	.26 (.15)	.15 (.09)
P_i^*	-1.27 (.31)	-1.9 (.31)	.75 (.78)	.13 (.26)	-.96 (.03)	-1.4 (.16)	-.67 (2.7)	-1.4 (.4)	-.01 (.79)	-1.1 (.4)	-.95 (.04)

See Appendix 1 for complete variable list.