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Food Demand Systems in Nepal During 1990s: An Initial Assessment

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Abstract

Food demand system is estimated for a 15-commodity model separately for the rural and urban localities. The demand systems are estimated for a consumer who chooses quantities so as to minimize the total expenditure to attain a given utility. The data are obtained from a survey on living standards. The income elasticities of demand have increased for cereals and pulses but decreased for the horticulture and meats. The price elasticities of demand have increased across the board. A case has been made to compensate the people to let them remain on the utility levels of a decade ago at least. The income elasticities of demand for food are smaller than the assumptions of Agricultural Perspective Plan 1995-2015. The own-price elasticities of demand have expected (negative) sign in about two-thirds of cases but these were significant in far less number of cases. Weak response of consumers to the higher prices may be attributed to their inadequate ability to optimize, lack of market penetration and subsistence farming system. Many cross-price elasticities are significant as complements and substitutes for almost every commodity. Some inconsistency exists between the consumption data and consumer theory. It suggests some topics for further research.

Introduction

Estimation of food demand system is a step in the direction of food policy analysis, commodity market modeling and agricultural planning. Its importance may be still higher in the context of the Nepalese economy where the incidence of absolute poverty and the concerns for food security are paramount. Therefore, the economic development plans have emphasized poverty alleviation as its sole objective. Their lead-strategy is to transform the subsistence agriculture into a commercial one. It is often said to be the market-led approach.

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Market models for the agricultural commodities are scarcely available. So, attempts are made here to estimate the food demand systems for a 15-commodity model using the data from the Nepal Living Standards Survey (NLSS) 1995/96. The commodities considered are rice, wheat, maize, pulses, potatoes, vegetables, fruits, mustard oil, milk, buff meat, mutton, chicken, eggs, fish and sugar. In addition, attempts are made to compare the changes in demand elasticity during the 1984/85 - 95/96 period for a group of six foods, namely, cereal grains, pulses, fruits and vegetables, meat fish and eggs, milk and curd, and oils and fats. Methods to improve the estimates of demand models are also suggested.

Past Studies

This section briefly reviews the demand studies in the past. Attempt to estimate the food demand systems in Nepal began from late eighties as shown in Table 1. Mudbhary (1988) noted that the past studies were partial demand analysis of a single commodity. These were directly specified without any reference to the utility theory. He estimated the Almost Ideal (AI) demand system for six food groups for three income classes (low, middle and high) and pooled average based on the household budget survey in 1984/ 85 (NRB 1988). The assumption of homogeneity was rejected for cereals, dairy products and oils. He observed that cross-elasticities are not always significant or reliable. Pulses, meat and oils are complements to grains. Pulses and meat are substitute for fruits and vegetables. Both these results are consistent with the observed patterns of Nepalese diet.

Thapa and Rosegrant (1995) estimated the food characteristic (FC) demand system with respect to the income and prices for rice, maize and wheat using the above household survey 1984/85. The demand system was estimated for the terai, hills and mountain regions and the low and high-income groups in each region (i.e., six situations) separately. The income elasticity of demand for rice, a preferred staple in Nepal, was higher than that for wheat and maize. Also maize and wheat have negative income elasticities in Terai, which is food surplus region. The income elasticities of demand are higher for low-income classes/ regions. We present in the table below a population-weighted average of their estimates of FC demand systems. The elasticity of demand for rice with respect to income and own-prices turned as 0.54 and -0.81, respectively.

APROSC and JMA (1995) prepared Nepal Agricultural Perspective Plan (APP) for the 1994/95 to 2014/15 period. It assumed that supply-driven process would generate the required growth of food grains, cash crops, fishery and forestry. And demand-driven forces will generate the required growth of horticulture and livestock sectors. The APP adopted income elasticity of demand for the horticulture as 0.8 to 1.0 and that for livestock as 1.0 to 1.5 (FAO 1993). The APP's assumptions about income elasticity of demand remain to be confirmed with the field data.

Table1: Comparison of Demand Elasticity During 1980s by Different Authors

Sr. No	Commodities	Thapa & Rosegrant		APP	Paroda & Kumar
		Price elasticity	Income elasticity	Income elasticity	Expenditure elasticity
1	Rice	-0.81	0.54		0.02
2	Wheat	-0.98	-0.19		-0.11
3	Maize (*)	-0.93	-0.10		-0.15
4	Pulses				0.26
5	Root and tubers				0.30
6	Vegetable oils				0.11
7	Vegetables			0.80	0.57
8	Fruits			1.00	0.69
9	Milk			1.00	0.63
10	Meat			1.20	0.67
11	Poultry			1.50	
12	Eggs			1.50	
13	Other foods				1.18
14	Non foods				1.92

(*) For Paroda and Kumar (1989), maize also includes other coarse grains.

Paroda and Kumar (1999) estimated the expenditure elasticity of demand for 11 food items in Nepal (as part of a study in South Asia) by applying the FC demand system on the data from FAOSTAT. The expenditure elasticities are around 0.6 for different horticultural and livestock products but these were negative or highly inelastic for the cereals. The commodities with cheapest source of calories had the lowest income elasticities. The magnitude of the food demand elasticity was about 0.42 while the calorie income elasticities were not significantly different from zero because of structural shifts in the dietary patterns from low-cost calorie food to high-cost calorie food items.

FAO (2000) and CEDA (2002) estimated the demand elasticity by applying Cobb Douglas (CD) functions on the data from living standards survey 1995/96 (CBS 1996 and 1997). This data is also used in a FAO study on agricultural policy simulations (Thapa, 2001).

Methodology

Concept of AI Demand System

Details about the derivation of the AI demand system and the formulae for the computations of the demand elasticities can be found in Deaton and Muellbaur (1980), Mudbhary (1988), and Thomas (1993). The Almost Ideal Demand system (AIDS) makes use

of the concept of duality. The consumers' problem is normally expressed as that of choosing quantities consumed so as to maximize utility subject to the budget constraint that total expenditure should not exceed a given level "x". That is, the consumers choose quantities so as to minimize the total expenditure necessary to achieve a given utility level "u". So we can obtain a consumer's cost-function by substituting the solutions to the expenditure-minimizing problem into the expression for total expenditure. Thus in a 15-commodity model, the consumer minimizes

$$x = p_1q_1 + p_2q_2 + \ldots + p_{15}q_{15} \qquad (3.1)$$

subject to the constraint that he attains a given utility U^* where

$$U^* = U^* (q_1, q_2, \ldots, q_{15}) \qquad (3.2)$$

These yield cost-minimizing quantities of $q_1, q_2, \ldots, q_{15}$ which depend on U^* and the given prices, $p_1, p_2, \ldots p_{15}$

$$q_1, = f (p_1, p_2, \ldots, p_{15}, U^*); q_2 = f (p_1, p_2, \ldots, p_{15}, U^*), \ldots, q_{15}, = f (...); \qquad (3.3)$$

The equations (3.3) are normally referred to as Hicksian or compensated demand functions. Substitution back into equation (3.1) for $q_1, q_2, \ldots, q_{15}$ yields the consumer's cost-function

$$x^* = (p_1, p_2, \ldots p_{15}, U^*) \qquad (3.4)$$

The cost function yields the minimum expenditure necessary to obtain the utility level U^* at given prices, $p_1, p_2, \ldots p_{15}$. The AI demand system has a flexible functional form for the cost function of an individual household "h":

$$\log x^h = a_0 + \log k^h + S_i a_i \log p_i + {}^1/_2 S_i S_j g_{ij}^* \log p_i \log p_j + U^h b_0 p_1 b^1 p_2 b^1 \ldots p_n b^n \qquad (3.5)$$

where x^h and U^h are the total expenditure and utility of the h_{th} household. k^h is a parameter that varies across households. Also, a_i is the intercept, and $g_{ij,}$ and $b_{i,}$ are parameter for price and income, respectively.

Deaton (1997) has provided a method for analysis of spatial price variations. In developed countries, the price variations have come from price changes over time. But in developing countries, transport is often more difficult, markets are not always well integrated, and even the presence of potential arbitrage cannot equalize prices between different geographical locations. In consequence, the developing countries have the regions as a source of price variations. So data on spatial price variations from sources like the household expenditure survey, living standards survey, consumers price indexing survey etc can be used to estimate a demand system (pp. 283–85). He has also stated that the long-run price elasticities are absolutely larger than the short-run elasticities and that the regional dummies may capture some of the long-run price effects (p. 323).

Estimation of AI Demand System

The food demand elasticities are estimated here using the AI demand system in conjunction with the Workings Model and Cobb-Douglas function. The specification of Working's model

for the rural or urban sectors (s) is specified as follows:

$$W_s = \mu_s + b_s \log X \qquad (3.6)$$

Where,

W_s: Sum of expenditure on the above 15 foods as a fraction of "X".

X : Aggregate expenditure on food, housing and other non-foods

The AI demand system uses the budget share of consumer for a commodity as the dependant variable and the expenditure and prices as the explanatory variables. In addition, we also include the market development index (M) and family size (F) among the explanatory variables (Ref data below). Thus, the AI demand system to be estimated is as follows:

$$W_{ib} = a_i + \sum_j g_{ij} \ln P_{jb} + b_i \ln (X_b / P^*_b) + m_i \ln M_b + h_i \ln F_b + U_i \qquad (3.7)$$

Where,

i, j = Food groups 1, 2, ..., 15 for the rural and urban areas separately,

b = Ward-wise averages as number of observations (b = 1,2,..., 59 for urban area and 1,..., 63 for rural areas).

Equation (3.6 and 3.7) are subject to the following definitions.

W_{ib} is the budget share of a food item "i" to the total per capita expenditure on all 15-food items in a ward "b". It adds-up to unity.

a_i is the intercept, and g_{ij}, b_i, m_i and h_i are parameter for price, income, market development index and household size, respectively.

$\log P_{jb}$ is the log of weighted arithmetic average of price of food group "j" in ward "b". Here, the weights are the quantity of a food consumed within a sub-group.

$\ln (X_b / P^*_b) = \ln X_b - \ln P^*_b$. It gives the real per capita expenditure on the 15-foods in a ward "b". Here

$$\ln P^*_b = \sum_j w_j \ln P_{jb}$$

Expenditure weights (w_j) vary from ward to wards depending on the contents in the food-basket. Likewise, (P_{jb}) imply that prices are for specific foods by wards.

$\ln M_b$ = log of marketing development index (M) by wards "b".

$\ln F_b$ = log of average household or family size by wards "b".

U_i = Stochastic error terms assumed to be normally and independently distributed with zero mean and constant variance.

The homogeneity restriction $\sum \gamma_{ij} = 0$ is imposed on equation (3.7). The numeraire used here is the price of rice. So the price parameters for rice are estimated separately as follows:

$$\gamma_{in} = 0 - \sum_{j=1}^{n-1} \gamma_{ij} \qquad (3.8)$$

In respect of Equation 3.7, the total number of demand functions estimated was over 60 in number (that is, 15 commodity group separately for the rural and urban areas using the unrestricted and homogeneity-constrained models). The Food demand system is estimated by applying weighted ordinary least squares (WLS) methods. WLS preempts the severity of heteroscedasticity and increases the efficiency of the estimators. As a measure of multicollinearity, the inter-correlations among the explanatory variables are high (not shown here). But the coefficients of determination are also high. It is considered satisfactory relative to the multicollinearity problems at this stage.

Data

A brief description about the Nepal Living Standards Survey (NLSS) and the nature of the data is as follows. Six major surveys on consumption have been conducted during the 1973–2001 period. These can be found in Nepal Rastra Bank (NRB 1976, 1988, 2000), National Planning Commission (NPC 1983) and Central Bureau of Statistics (CBS 1996/ 1997, 2002). Of these, CBS (1996) is the latest source for a data set on both the consumption and prices for both the rural and urban localities.

CBS with assistance of the World Bank had conducted the NLSS during June 25, 1995 to June 15, 1996. The NLSS objectives were to: monitor progress in improving the national living standards of the people, and evaluate the impact of government policies and programs on the peoples' living conditions.

NLSS sampling frame was prepared in two stages. First, the 1991 Population Census was used to list all wards with their sizes, and it was adjusted for the NLSS listing. Probability proportional to size (PPS) sampling method was used to select 274 wards throughout the country (covering 73 out of the 75 districts). Secondly, systematic sampling was used to select 12 to 16 households per ward. It gave a sample size of 3,373 households. The sample was designed to generate estimates in either three ecological belts (terai, hills and mountain) or five development regions, or two urban/ rural localities.

NLSS was implemented over a full year to cover a complete cycle in the agricultural activities and to capture the seasonal variations in other variables. Field works took place in four phases starting from 1995 June (28 wards), August (66 wards), October (93 wards) and January1996 to complete rest of the work. The 12 months prior to interview were taken as the relevant accounting period.

In the present analysis, the data for estimating the food demand system are generated in five steps as follows. First, the zero values of dependant variables are removed by progressively merging the information from 215 wards to create 63 rural-blocks throughout the country. NLSS covered 59 wards in the urban sample. Second, the prices of foods received in kind are estimated by taking a weighted average of the prices for home produced and market purchased

quantities. Third, mistakes in survey data entry are edited as far as possible. Fourth, income outlier-households are excluded. Finally, the weights assigned to household are used in all analyses.

Of the variables used in the demand models, average consumption per capita of a food item in a ward is measured as the total consumption of that food divided by the weighted sum of individuals in the ward. Average price of a food item in a ward is its total value of consumption divided by its total quantity of consumption in the ward. For the food groups, value weights are used in the aggregation (as done by Mudbhary, 1988).

Market development index is the inverse of time spent to access the market places, institutions, motorable roads and the like.

Results and Discussions

The results of the present analysis are presented in Table two to six. A summary of the data being analyzed is to be found in Table-2 in terms of the average income, expenditure and the expenditure elasticity; the latter is estimated from the Workings Model. Likewise, details about consumption of food commodities are to be found in Table-3 in terms of kilograms per capita, prices and budget shares. The changes in demand elasticities for six-food groups during 1985-95 are presented in Table-4. The demand elasticities by commodities for the homogenous-AI demand system in the urban and rural localities are to be found in Table-5 and Table-6, respectively. Finally, Table-7 presents some cases where the laws of demand and the food consumption data have apparently fallen apart. The parameters and their standards errors of the demand functions are not reproduced here for want of space. Likewise, the values on the coefficients of determination and analysis of variances are mentioned minimally only while discussing the results. Similarly, some references are made to the expenditure elasticity where the results of the AI demand system are deemed too difficult to accept.

As we moved from the unrestricted AI demand system (not shown here) to estimate the homogenous food demand system, it hardly improved the analysis of variance and coefficients of determination. The number of significant parameters with respect to expenditure and prices increased from 214 to 222 (i.e., from 83 to 97 and from 124 to 125 in the rural and urban locality, respectively). The signs of price parameters were affected in 43 (10%) cases. However, the number of unexpected signs of own-price elasticity and expenditure elasticity in the demand function for urban area increased. Nevertheless, the elasticity coefficients of the homogenous demand functions more smooth.

Out of 30 equations, the assumption of homogeneity is rejected only in five cases: fruits, buff and mutton in urban area and rice and oils in rural area. It follows a brief discussion of the results about Engel's law, effect of demographic factors, and the demand systems for groups of foods and individual commodities.

Engel's Law and Changes in Demand Elasticity during 1985-95

Out of the average annual income of Rs 7.8 thousand per capita, the consumption expenditure was Rs 6.8 thousand per capita (88.5%) in the year 1995/ 96 (Ref Table 2). In the total consumption expenditure, the share of 15 foods is 31 percent and 48 percent in the urban and rural localities, respectively. The estimates of Working's model show that the elasticity of total expenses on 15 foods with respect to the aggregate expenditure is much higher in rural area than that in urban area. It is in line with the Engel's Law. The total food expenditure elasticity with respect to aggregate expenditure turned as 0.92 and 0.75 in rural and urban localities, respectively, for the year 1995/96. These expenditure elasticities are higher than the national food expenditure elasticity of 0.67 in the year 1984/85 (Mudbhary 1988: 84). Thus, the food expenditure elasticities have increased overtime. It should have declined if there was high and equitable economic growth.

Rural and urban localities are similar in terms of the quantity of food consumption per capita but they remarkably differ in its composition (see Table 3). The per capita food consumption in both places is about 233 kg annually or 640 grams daily. The percentage share of rice is about two-fifth in the total food expenditures. But the share of coarse cereals is high in rural areas at 18.4 percent as compared to just 4.5 percent in urban areas. On the other hand, the share of pulses, fruits, vegetables and livestock products is about 49.2 percent in the urban locality as compared to 36.7 percent in rural locality. The prices of almost all foods are lower in rural locality than in urban locality. Thus the consumers in rural area have attained the consumption target in terms of quantity (at par with the people of urban area) by choosing more of the cheaper products for consumption.

The demand elasticities for major food groups have undergone changes during the decade of 1985-95 (see Table 4). First, the total expenditure elasticities for necessities like cereals have increased from around 0.35 to 0.60. For pulses, it increased form 0.36 to 0.92. That is, the expenditure elasticities for food grains have nearly doubled. On the other hand, the expenditure elasticities for luxuries like fruits and vegetables, meat, egg and fish, or oil and fats have decreased by about one-third to one-half. The highest decline of expenditure elasticities was for the group of meat, fish and egg from 2.62 to 0.93. Secondly, the compensated own-price elasticities have increased for cereals, pulses, fruit and vegetables, or meat fish and egg groups by about 20 percent to one-half. The price elasticity for oils and fats have reversed from negative to positive.

To conclude, the consumers' have become more sensitive to prices and real incomes during the decade of 1985-95. It reflects the falling purchasing power in the 1990s. They need compensation to remain on their utility levels as in the 1980s.

Effects of Localities, Market Access and Family Size

Estimation of food demand function turned more successful in urban areas, where the transactions in money are high. On the whole, the coefficients of determination (R^2) are around 0.5 and 0.7 in the rural and urban areas, respectively.

Rural locality: Market development index (MDI) has increased the demand for rice, pulses, fruits, mutton and chicken. It decreases the demand for maize. The demand elasticity with respect to household size is negative for buff, mutton, egg and fish. It indicates significant economies of scale in household consumption (Table 6). It may also impair the access of women, children and old people to food within the households.

The compensated food demand elasticity with respect to own-price gave regular (negative) coefficients for 11 out of 15 foods (refer to the diagonal elements in Table 6). Such count was similar under the unrestricted-AI demand system (as singled-out in Table 7). Thus from the point of view of the law of demand, both the unrestricted and homogenous AI demand systems may be said to be equally good fit in the rural areas.

The expenditure elasticity of demand for foods larger than unity implies that the preferred foods are rice, maize, pulses, poultry and fish. Potato and mutton have unity elasticity. Vegetables, fruits, milk, eggs, buff and oil are necessities. The expenditure elasticities for wheat and sugar (mostly gur) have negative signs.

Urban locality: MDI has increased the demand for potato, vegetable, chicken and egg. It reduced the demand for maize (Ref Table 5). Family size has increased the demand for rice, vegetable and sugar. It reduces the demand for maize, potato, fruits and fish.

Under the unrestricted AI demand system, the compensated own-price elasticity coefficients had regular (negative) sign for 12 out of 15 foods. But under the homogeneity restriction, it decreased to seven out of 15 commodities. Thus the restriction of homogeneity has produced more unexpected signs of the own-price elasticity coefficients in the urban locality!

The expenditure elasticity of demand indicates that the preferred foods are rice, maize, potato, fruits and fish. Foods like wheat, pulses, vegetables, milk, buff and sugar are necessities. The expenditure elasticity of demand for mustard oil, mutton and chicken turned negative. That is, the urban consumers try to avoid such foods when their income increases.

Commodity Demand Elasticity with Respect to Expenditure and Prices

Demand system for commodities in terms of the expenditure elasticity and compensated price elasticity need more scrutiny. First, rice includes coarse rice and fine rise but beaten rice is not considered here. Expenditure elasticity of demand for rice turned as 1.2 for both the rural and urban localities. This is very high as compared to the previous estimates for Nepal. It may be attributed to (a) increase in the income elasticity over the years and (b) possible overestimation of the elasticity by the AI demand system. Own-price elasticity of demand for rice did not turn significant in rural area although its coefficient of –0.80 is close to the estimates of Thapa and Rosegrant (1995).

Second, maize includes whole grain and maize flour. Expenditure elasticity of demand for maize turned as high as 4.5 in urban area. Perhaps it indicates that a narrow section of urban consumers use maize flour of high quality. Likewise, the demand for maize with own-price is even more elastic. Four cross-price elasticities are significant (complements: wheat

and oils, substitutes: milk and buff). Egg prices emerged as substitute for maize.

Third, the demand for wheat with respect to expenditure turned significant only in rural area with an elasticity coefficient of –0.2. Its absolute size is twice larger than the earlier estimate of FC demand system for the country. In urban area, own-price elasticity has expected negative sign but it turned insignificant. Here seven cross-price elasticities are significant (complements: vegetable and fish, and substitutes: pulses, fruits, milk, chicken and eggs).

Fourth, pulses include black pulses, lentil, arahar and grams. The expenditure elasticity for pulses did not turn significant even at 20 percent level. Further in rural area, own-price elasticity has an expected negative sign with –0.3 but it is insignificant. Here five cross-elasticities are significant (complements: rice, eggs and sugar, and substitutes: milk and chicken).

Fifth, the expenditure elasticity of demand for potato did not turn significant but it is around unity in both localities. In rural locality, the elasticity of demand with respect to own-price has expected sign with the coefficient as –1.3. Here four cross-price elasticities are significant (complements: mutton and fish, and substitutes: chicken and sugar).

Sixth, vegetables include onion, cauliflower, cabbage and tomato. As assumed by APP, the expenditure elasticity for vegetables is 0.8 (but insignificant) in urban area. The expenditure elasticity of demand for vegetables is much less at 0.5 in rural locality. A cross check with Cobb Douglas (CD) function on the same data gave expenditure elasticities for vegetables as around 0.5 as follows.

Potato	0.44	Onions	0.41
Cauliflower	0.61	Tomato	0.58

In rural area, the demand for vegetables with respect to own-price has expected sign and is inelastic (with e = -0.6) but it did not turn significant. Five cross-price elasticities are significant (complements: pulses and oils, and substitutes: maize, buff and fish).

Seventh, fruits include banana, citrus, mango, apple, pineapple and papaya. The expenditure elasticity of demand for fruits ranged from 0.7 to 1.2 in the rural and urban localities, respectively, but it did not turn-up significant. Nevertheless, these elasticities converge to the APP's assumptions about the income elasticity of demand for fruits as unity. But a cross checks with CD function gave expenditure elasticity of demand for fruits far below unity as follows.

Banana	0.49	Mangoes	0.65
Citrus	0.63	Apples	0.48
Papaya	0.48	Pine apple	0.65

Eighth, oils include mustard, sarsiyou and vegetable ghee. The demand for oils with respect to expenditure is inelastic (e = 0.5) indicating that it is a necessity in the rural locality and an inferior good (e = -0.7) in the urban locality. The demand for oils with respect to own-price is elastic with the coefficients of -1.5 to -2.5 in the rural and urban localities, respectively, but it is significant only in urban area. In the later case, eight cross-price elasticities are significant (complements: mutton, chicken, milk and sugar, and substitutes: pulses, potato,

mutton and fish).

Ninth, milk includes fresh milk and curd. The quantity of curd was multiplied by 1.5 to make the volume at par with milk for the calculation of prices. Demand for milk with respect to expenditure turned steeply inelastic (e = 0.1) in urban area and 0.7 (insignificant) in rural area. In either case, expenditure elasticity is much smaller than the APP's assumption of the income elasticity of demand as 0.8. As a cross check, the CD function gave expenditure elasticity of demand for dairy products in the range of about 0.4 to 0.8 as follows:

Milk	0.80	Baby food milk	0.75
Curd	0.38	Ghee	0.60

Tenth, the demand for buff with respect to expenditure is inelastic (e = 0.2) in rural areas. The demand for buff (with respect to own-price) has the expected negative sign and is elastic (e = -1.1) but it did not turn significant. Four cross-price elasticities are significant (complements: milk, chicken and sugar, and substitutes: eggs).

Eleventh, mutton refers to meat of goats, chyangra and sheep. The expenditure elasticity of demand for mutton turned negative and inelastic in urban area (e = -0.1). It has unit elasticity but did not turn significant in rural area. A cross checks with CD function gave expenditure elasticity of demand for mutton as 0.64. Thus, the APP assumption of income elasticity of demand for meat (buff and mutton) as 1.2 appears to be an overestimation. The own-price elasticity of demand is significantly inelastic with expected negative sign in urban area. Here, eight cross-price elasticities are significant (complements: pulses, potato, buff and fish, and substitutes: wheat, vegetable, fruits and milk).

Twelfth, demand for chicken with respect to expenditure is elastic (e = 1.4) in rural locality but it turned negative (e= -0.2) in urban area. A cross checks with CD function gave the expenditure elasticity of demand for chicken as 0.45. These expenditure elasticities are smaller than the APP assumption of income elasticity of demand for poultry as 1.5. The own-price elasticity of demand for chicken varies from –0.5 to –1.4 in the rural and urban areas, respectively, but neither could turn significant. In the urban locality, two cross-price elasticities are significant (sugar as complement and wheat as substitute)

Thirteenth, the expenditure elasticity of demand for egg ranged from 0.8 (insignificant) to –0.1 in the rural and urban areas, respectively. A cross checks with CD function gave the expenditure elasticity of demand for chicken as 0.55. These are far below the APP assumption of income elasticity of demand for eggs as 1.5. The own-price elasticity of demand for eggs ranged form –0.3 to –4.5 for the rural and urban areas, respectively. In urban areas, five cross-price elasticities are significant (complements: pulses and sugar, and substitutes: rice, wheat and vegetable).

Fourteenth, the demand for fish with respect to expenditure is elastic with coefficients as high as 1.2 to 2.5 in the rural and urban localities, respectively. The own-price elasticity of demand for fish ranged from –0.7 to –2.0 (both insignificant) for the rural and urban areas, respectively. In urban area, five cross-price elasticities are significant (complements: vegetables, buff and mutton, and substitutes: potato and eggs).

Finally, sugar also includes gur. The demand for sugar is very inelastic as the expenditure

elasticity ranged from –0.4 to 0.03 in the rural and urban localities, respectively. The own-price elasticity of demand for sugar has expected negative sign with a coefficient of –2.0 in rural areas. The cross-price elasticity implies vegetable as substitute.

Conclusions and Recommendations

The National Living Standards Survey 1995/96 show that the households' total consumption and expenditure on foods were 88 percent and 40 percent of their income, respectively. It indicates that the consumers in rural area attain quantitative consumption targets at par with the consumers in urban area by choosing more of the cheaper products.

Estimates of the demand elasticities for six-food groups show that the total food expenditure elasticities have increased from 0.67 in the country during mid-eighties to 0.75 and 0.92 in the urban and rural areas, respectively, by mid-nineties. The expenditure elasticities of demand for the "very basic needs" like cereals and pulses have nearly doubled. On the other hand, the expenditure elasticity of demand for the "luxury" food-groups like fruits and vegetables, or meat egg and fish or oils and fats have decreased by about one-third to one-half. The compensated own-price elasticities have increased for most foods. Thus, the consumers have become more sensitive to change in prices. In other words, the consumers' purchasing power must have been falling and, hence, they need larger compensations to remain on their utility levels at least as in the 1980s.

The law of demand or consumer theory and the actual data fall apart in good number of cases. The assumption of homogeneity was rejected in five out of 30 cases (fruits, buff and mutton in rural area, and rice and oils in urban area). The signs of own-price elasticities were not regular/stable in 7 to 12 out of 30 cases in the unrestricted and homogeneity constrained demand systems, respectively.

The intra-household equity may have improved with socio-economic developments. Household size is a significant determinant of food demand per capita in 11 out of 30 cases. The per capita consumptions are reduced with increase in family size for maize, potato, fruits and fish in rural area and for buff, mutton and eggs in the urban area. These may affect the intra-household equity because it may reduce the access of women and children to food. The per capita consumption increases with family size for rice, vegetable and sugar in the urban areas.

Market access is found to increase the demand for rice, pulses, potato, fruits, mutton and chicken. It decreases the demand for maize.

Expenditure elasticities of demand turned significant in 16 out of 30 cases. The preferred items are rice, chicken, fish and maize in rural area and rice, maize and fish in urban area. The necessities are vegetables, oils and buff in rural area and milk and sugar in urban locality. The expenditure elasticities of demand for commodities with negative sign increased from two (wheat and sugar) to four (oils, mutton, chicken and eggs) in rural and urban area, respectively. Thus with higher incomes, the urban consumers have become more selective in the demand for foods.

Most of the elasticities of demand for horticulture and livestock products are less than the assumptions of APP.

The compensated own-price elasticities have regular (negative) sign for 18 out of 30 cases. However, the negative-own-price elasticity of demand turned significant only for four commodities (maize, oils, mutton and eggs) in urban area and for eggs alone in the rural area. That is, the food market (in the short-run) is little developed. Also, the own-price elasticity of demand is positive in 12 out of 30 cases. It may indicate that the Nepalese consumers' behavior with respect to prices may be at an early stage of rational choices or optimization. In a subsistence economy, the consumption of foods are determined by farming system, cropping pattern, unsold surplus, or food availability besides the prices and habits.

The demand elasticities estimated here may provide some basis for policy-analysis. The demand system for foods may be further improved as follows. First, the demand system may be estimated by pooling the observations in the rural and urban localities. One may concentrate on the price and income elasticities of demand. Second, data may be pooled from different consumption surveys to examine the effects of larger changes in relative prices over a decade. Third, one may estimate the models such as FC demand system, linear expenditure system and some ad-hoc single equations alongside the AI demand system to make comparative evaluations of the demand elasticities. Finally, the AI demand system may be made "complete" by allowing for "all other prices" or "prices of non-foods", and estimate with all the theoretical restrictions. Given the proper estimates for such demand functions, market-modeling and policy evaluations can be feasible with more precision.

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Table 2: Income, Consumption and Food Expenditure Elasticity by Locality, 1995/96

S. N.	Particulars	Units	Urban	Rural	Country
1	Average income	Th Rs/year	16.1	7.1	7.8
2	Total expenditure	Th Rs/year	14.9	6,1	6.8
3	Food expenditure annual	Rs/ capita	4.6	2.9	
4	Expenditure on 15 foods	% of total	30.6	48.1	
5	Expenditure elasticity (1995) (a)		0.753*	0.917*	
6	Expenditure elasticity (1985) (b)		-	-	0.666

Note:(*) Significant at five percent or lower level of significance (#) Significant for 10 per cent. ($) significant at 20 percent (considered for expenditure and own-price elasticities only.

Sources: (a) Present estimates from CBS (1996), (b) Based on Mudbhary (1988).

Table 3: Consumption, Prices and Budget Share of Different Foods, 1995/95

Sr.No.	Food Items	Consumption Kg/ cap		Price Rs/ kg		Budget share (%)	
		Urban	Rural	Urban	Rural	Urban	Rural
1	Rice	104.8	95.8	15.5	14.4	44.3	42.7
2	Maize	8.1	44.6	6.4	6.7	2.1	11.9
3	Wheat	18.4	28.9	9.7	8.2	2.4	6.5
4	Pulses	9.0	4.8	33.1	27.1	5.6	4.9
5	Potatoes	16.6	13.1	10.7	8.0	2.6	2.2
6	Vegetables	13.0	6.1	11.7	9.8	2.5	1.6
7	Fruits	12.0	7.3	13.5	9.1	2.8	2.6
8	M oil	5.0	2.7	66.9	67.4	8.5	5.3
9	Milk	32.5	22.9	15.3	13.3	10.1	10.8
10	Buff	2.4	1.0	36.9	26.9	4.8	2.2
11	Mutton	2.3	1.1	119.2	95.1	5.6	3.1
12	Chicken	1.2	0.6	90.0	78.2	3.0	1.9
13	Egg	1.9	0.4	50.0	46.8	2.1	0.8
14	Fish	1.0	0.7	68.9	51.2	1.6	1.3
15	Sugar/ gur	6.1	2.7	23.7	25.8	2.6	2.1
	Total	**234.1**	**232.7**			**100.5**	**100.0**

Source: CBS (1997): NLSS Data Diskettes.

Table 4: Changes in Food Demand Elasticity During 1984/85 - 95/96

S.No.	Food groups and	Total expenditure elasticity factors affecting demand		Compensated own-price elasticity	
		1984/85 (a)	1995/96 (b)	1984/85 (a)	1995/96 (b)
1	Cereal grains	0.35	0.6	-0.33	-0.38
2	Pulses	0.36	0.92	-0.33	-0.37
3	Vegetables & fruits	1.65	1.07	-0.8	-0.89
4	Meat, fish and eggs	2.62	0.93	-0.83	-1.46
5	Milk and curd	0.77	0.74	-0.4	-0.4
6	Oils and fats	1.42	0.56	-0.59	0.38

Sources: (a) and (b) as in Table 2 above.

Table 5: Homogeneity-constrained Food Demand System in Urban Locality

S. No	Demand for foods	Compensated Elasticity with respect to the Changes in Prices of															Elasticity with			R 2	F-value
		Rice	Maize	Wheat	Pulses	Potato	Veget	Fruit	M. Oils	Milk	Buff	Mut'n	Chick'n	Eggs	Fish	Sugar	Expen	MDI	H size		
1	Rice	**1.8***	0.2	-2.7*	0.9	-0.3#	0.0	-1.8*	-0.7	-0.6*	0.8*	0.8*	0.7#	-1.3*	0.3	2.1*	**1.2***	1.2	1.7#	0.82	10.9
2	Maize	-4.2	**-6.3***	4.0*	-3.5	0.5	-3.8	4.3	17.5#	-4.2*	-3.9*	-1.9	3.8	4.4	2.1	-8.7	**4.5***	-2.1*	-10.1*	0.72	6.2
3	Wheat	-5.7	0.9	**-2.0**	4.3#	-0.8	-8.3*	2.5#	-2.0	3.6*	-1.2	-0.8	2.7#	6.2*	-4.9*	5.5	**0.2**	0.6	3.1	0.86	14.4
4	Pulses	-2.7#	0.3	0.3	**0.7$**	0.8#	-1.1#	1.5*	-2.2#	0.8	-1.5*	-1.2*	0.7	2.9*	-0.9	1.7	**0.5**	0.9	0.4	0.70	5.6
5	Potato	-2.1	0.4	-0.9	0.6	**1.2***	-0.7	0.7	0.6	0.0	-1.4*	0.5	-0.8	0.1	0.6	1.3	**1.2**	1.9*	-0.1#	0.72	6.1
6	Veg	-1.2	0.3	2.0#	-2.0*	1.0*	**0.1#**	0.7	0.9	1.3*	-1.0#	-1.6*	-0.5	-0.1	-0.3	0.3	**0.8**	1.5*	0.2#	0.79	9.3
7	Fruits	-0.4	0.1	1.4*	-1.6*	0.8*	-0.1	**0.8***	1.0#	0.8*	0.0	-1.4*	-0.6*	0.2	0.0	0.2	**1.2**	1.3	-0.8#	0.88	17.6
8	Oils	0.8	0.1	1.1	1.6#	0.7*	0.0	-0.1	**-2.5#**	-0.6#	-0.5	0.7#	-1.6*	-1.2#	2.4*	-0.9	**-0.7***	0.8	1.0	0.77	8.0
9	Milk	-1.1	0.1	2.4*	-1.3	0.3	1.3*	1.7*	1.8#	**0.4***	-0.7	-1.4*	-2.0*	2.1*	0.0	-3.7*	**0.1***	1.0	1.5	0.77	8.0
10	Buff	2.4	-1.0	1.6#	-2.1	-1.2*	1.7#	0.0	-0.7	-0.7	**1.8***	0.5	-0.5	-0.6	0.2	-1.5	**0.3**	0.9	2.2	0.55	3.0
11	Mutton	-2.1	-0.5	5.8*	-3.0*	-1.0*	1.5#	2.2*	-0.6	2.2*	-1.3#	**-0.1$**	0.1	0.6	-2.1*	-1.8	**-0.1#**	0.9	-0.4	0.64	4.4
12	Chicken	-2.9	0.2	5.8*	1.2	0.8	1.1	1.5	0.0	0.2	1.3	-0.2	**-1.4**	0.6	-0.1	-7.9*	**-0.2$**	0.2#	0.2	0.56	3.1
13	Eggs	3.9#	0.3	5.2*	-2.8*	-0.3	2.3*	0.8	-0.3	-0.4	0.6	-0.3	-0.1	**-4.5***	-1.1	-3.2#	**-0.1***	0.8	2.1	0.77	8.1
14	Fish	-3.3	1.0	0.8	0.3	1.1	-7.2*	4.6*	-1.1	0.5	-1.3	1.9#	-0.3	4.6#	**-2.0**	0.6	**2.5***	1.2	-3.7*	0.50	2.5
15	Sugar	-0.9	0.5	-0.6	0.5	0.7#	0.1	1.2*	-1.0	0.5	0.5	-0.9#	-2.2*	0.9	0.7	**0.1**	**0.03***	1.2	2.5*	0.56	3.1

Table 6: Homogeneity-constrained Food Demand System in Rural Locality

S. No	Demand for foods	Compensated Elasticity with respect to the Changes in Prices of															Elasticity with		R 2	F-value
		Rice	Maize	Wheat	Pulses	Potato	Veget	Fruit	M. Oils	Milk	Buff	Mut'n	Chick'n	Eggs	Fish	Sugar	Expen	MDI	H size	
1	Rice	**-0.8**	-0.2	0.0	0.5	0.3	0.1	0.0	0.7	-0.1	-0.1	-0.5	-0.1	-0.1	0.2	0.0	**1.2$**	1.5*	1.4	0.52	2.8
2	Maize	1.7	**-0.5**	-0.5	-1.1	0.7	-0.4	-0.6	-0.3	-0.5	-0.2	0.6	-0.5	0.8#	0.1	0.6	**1.2**	-0.5*	0.6	0.63	4.5
3	Wheat	1.6	-0.5	**1.5***	-1.6#	0.6	-1.2#	0.2	-2.1#	-2.0*	0.1	0.2	2.1*	0.0	-0.5	1.7#	**-0.2***	1.1	2.9	0.55	3.2
4	Pulses	-0.6	-0.4	0.0	**-0.3**	0.0	-0.1	0.2	-0.5	1.0#	0.2	-0.7	2.2*	-0.9*	-0.9*	0.9	**1.1**	1.6*	0.9	0.56	3.4
5	Potato	0.7	0.0	0.3	0.4	**-1.3**	-0.7	0.3	-0.8	0.6	-0.4	-1.2*	1.5*	0.1	-1.0*	1.3*	**1.0**	0.8	1.5	0.38	1.6
6	Veg	-0.4	2.0*	0.4	-1.1#	-0.8	**-0.6**	0.7	-1.7*	-0.1	0.8*	0.1	0.0	0.2	0.7#	-0.2	**0.5$**	1.2	0.5	0.30	1.1
7	Fruits	2.9*	0.1	0.8*	0.1	0.0	-0.2	**0.2***	-0.7#	-0.1	0.3#	0.1	0.1	-0.1	0.2	-3.1	**0.7**	0.5*	0.8	0.33	1.3
8	Oils	0.8	0.1	0.4	0.9#	-0.5	0.2	-0.2	**-1.5**	-0.3	0.5#	0.4	0.3	-0.4	-0.5#	-0.4	**0.5$**	1.2	0.8	0.34	1.4
9	Milk	-0.6	0.8	-0.7	0.8	-2.0*	0.8#	-0.4	0.2	**1.8***	0.3	0.7	-0.9#	-0.2	0.0	-0.4	**0.7**	0.8	0.8	0.66	5.1
10	Buff	1.8	0.3	-0.8	-0.9	1.1	0.3	1.0	1.7	-1.2#	**-1.1**	1.4	-2.1*	1.1#	0.7	-3.2*	**0.2$**	0.6	-1.6#	0.30	1.1
11	Mutton	0.0	1.2*	-0.8#	-1.8*	-0.2	1.3#	0.7#	-0.1	0.7	-0.2	**1.0***	-0.9#	0.2	-0.5*	-0.6	**1.0**	0.6*	-0.9*	0.60	4.0
12	Chicken	1.4	-0.5	0.0	-1.0	-0.5	0.1	0.9*	-0.4	1.0	0.2	0.5	**-0.5**	0.0	-0.1	-1.0	**1.4$**	0.1*	-0.1	0.50	2.6
13	Eggs	1.3	0.4	-1.1	-0.1	-0.8	0.0	0.9	1.2	0.3	0.6	-0.6	-1.2	**-0.3$**	0.8#	-1.5	**0.8**	0.7	-1.7#	0.42	1.9
14	Fish	-1.3	1.4	0.3	1.0	1.7*	-1.6*	0.4	1.5	0.3	-1.0*	-2.3*	-0.7	1.4*	**-0.7**	-0.6	**1.2**	0.9	-1.7*	0.36	1.5
15	Sugar	1.3	0.1	0.0	-0.7	-0.6	0.4#	1.1	0.3	-1.2	-0.4	0.6	1.2	0.1	0.6	**-2.0**	**-0.4***	1.3	1.3	0.30	1.1

Table 7: Cases of Inconsistent or Unstable Signs as per the Law of Demand

S.No	Cases	Compensated Own-price Elasticity			
		Rural Locality		Urban Locality	
		Unrestricted	Homogenous	Unrestricted	Homogenous
1	Rice			1.79	1.76
2	Wheat	-0.58	1.52		
3	Pulses			-4.04	0.74
4	Potato	0.06	-1.28	-3.57	1.19
5	Vegetables			-2.60	0.10
6	Fruits	-2.05	0.19	-3.30	0.82
7	Milk	-2.54	1.80	-2.45	0.40
8	Mutton	-1.47	1.02		
9	Buff	0.44	-1.10	1.05	1.80
10	Chicken	0.38	-0.45		
11	Eggs	0.61	-0.31	2.41	-4.46

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