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A CASE STUDY :

Consumption behaviour of rural households: A micro level study of Rajasthan, India

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KEY WORDS :
Changing pattern, Food consumption, Calorie intake, Milk, Meat, Fruits

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BACKGROUND AND OBJECTIVES

Changing pattern in food consumption and calorie intake has captured great attention among researchers and policy makers for a long time in India. Increasing preferences towards non-food from food items and from low to high value foods is evident in last three decades. NSS survey reveals that, share of consumption expenditure on food items had declined from 64.0 per cent in 1977-78 to 53.6 per cent in 2009-10 in rural India. In urban India, it was 56.4 per cent and 40.7 per cent, respectively during the periods (NSSO, 2010). Within food items, diversification from cereal dominated low-value traditional food basket towards high value commodities such as milk, meat, fruits, fish, processed food products etc. has been observed in several studies (Radhakrishna, 2006 and Kumar *et al.*, 2006; 2007 and 2011). While the share of cereals in total consumer expenditure in rural India declined steadily from 26.3 per cent in 1977-78 to 22.2 per cent in 1999-00 and to 15.6 per cent in 2009-10, expenditure on milk and milk products, egg, fish and meat, fruits and vegetables had increased gradually. Decline in cereal consumption expenditure was also noticed in urban India, although not as severely as was in rural regions. But the income spent on high value commodities remained decreasing, converse to the rural case (NSSO, 2010). While some authors note this decline as an indicator of improvement in welfare (Rao, 2000), others argue that the increasing expenditure on non-food items was not because of welfare improvement but because of increase in prices of essential non-food items like fuel, light, medical expenses, etc. (Saha, 2000).

While the real per capita consumption, income and wages are gradually increasing (in real terms), there has also been an offsetting reduction in calorie consumption. The mean per capita calorie consumption per day in rural India decreased from 2240 Kcal in 1983 to 2047 Kcal in 2004-05. The decline was about 10 per cent, being higher at the upper end of the expenditure distribution. In

contrast, real average monthly per capita expenditure increased by 22 per cent over the same period. Urban areas witnessed a milder decline in estimated average calorie intake, from 2070 Kcal to 2021 Kcal. The decline in per capita consumption is not limited to calories. It also applies to proteins and many other nutrients, the major exception being fat consumption, which has increased steadily in both rural and urban areas (Deaton and Drèze, 2009). Several explanations has been made to explain this puzzle, including movements in relative prices, impoverishment of a large section of rural India, diversification of food consumption, decline in calorie needs and a squeeze of the food budget (Basu and Basole, 2013), declining levels of physical activity, improvements in health environment (Deaton and Drèze, 2009). Above all, increasing inequality in calorie intake in major Indian states (Sethi and Pandhi, 2012) is the other dimension that one has to worry about.

Inference once could draw from above is that, both in terms of expenditure and calorie intake, the rate of decline is more in rural than in urban India. Possible reasons could be the declining levels of physical activity and various improvements in health environment in the country. Implications of such change are vital as poor consumption either in terms of expenditure or calorie or nutrition is linked directly with poverty levels in the country. Also, it signals the direction of change in production pattern to the farm sector that the economy demands. As this pattern of change is much broad and the estimates are aggregate measures, it can only be generalised for the economy as a whole or to a state. But the consumption behaviour and its response to changes in income and prices would vary widely by household size, taste preferences (Murty, 2000), income levels (Begam *et al*., 2010), inflation, differences in the urban and rural lifestyles, the development of more advanced marketing systems, occupational changes that are closely linked with increasing per–capita income (Kumar and Mathur, 1996), wealth, past levels of consumption etc. In this study, we try to understand the consumption behaviour of rural households, in a relatively small region. We employed the theoretical framework of almost ideal demand system (AIDS) to formulate our household demand system and solved through seemingly unrelated regression (SUR) equations. Further, we obtained different demand elasticities like price, income and cross elasticities.

RESOURCES AND METHODS

Models for estimating consumer demand could broadly be divided into primal and dual models. The well known primal models are Stone's Linear Expenditure System (LES) and Lluch's Extended Linear Expenditure System (ELES), of which the Quadratic Expenditure System (QES) of Howe *et al.* (1979) is a general form. LES and ELES are more flexible, because of the lower degree of non-linearity. With single equation estimation, they can be estimated linearly by OLS. But a common criticism of LES is that it is based on Geary-Stone utility function. It follows that the model assumes a linear Engel function and rules out inferior goods. Its strength lies in the utility maximising behaviour of the consumer in the model. Thus, its estimates have the two desired properties of consumer demand, additivity and homogeneity. Existence of non-linear relation in consumption pattern in India had been observed by several authors (Murty, 1999), and in this ground, it is reasonable to exclude LES and ELES for estimation. The weakness of QES is its high degree of non-linearity, which causes estimation difficulties and is time consuming.

The most widely used dual model is the Almost Ideal Demand System (AIDS). This has been the model of choice for many applied demand analysts for almost three decades (Nzuma and Sarker, 2010). Deaton and Muellbauer (1980) developed the model in which the budget shares of the various commodities are linearly related to the logarithm of real total expenditure and the logarithms of relative prices. The model has many desirable theoretical properties; it gives an arbitrary first-order approximation to any demand system; it satisfies the axioms of choice exactly; it aggregates perfectly over consumers without invoking parallel linear Engel curves; it has a functional form which is consistent with known household-budget data; it is simple to estimate, largely avoiding the need for non-linear estimation and it can be used to test the restrictions of homogeneity and symmetry through linear restrictions on fixed parameters. Although many of these properties are possessed by one or other of the Rotterdam or Translog models, neither possesses all of them simultaneously (Deaton and Muellbauer, 1980). AIDS model generates nonlinear Engel curves and allows for exact aggregation across consumers (Moschini, 1998).

Applicability of AIDS model in time series analysis requires consideration of non-stationarity and co-integeration related issues, still they have been

sidestepped in applied demand analysis and conventional econometric techniques like ordinary lease squares (OLS), seemingly unrelated regression (SUR) and maximum likelihood estimation (MLE) are used in estimation of the model. Having cross-sectional data, this study omits those considerations and free from the methodological bias. Having above knowledge, the present study applies AIDS and uses SURE for estimation.

The AIDS and LA/AIDS model :

The basic AIDS model is developed from a particular cost (expenditure) function taken from the general class of "price-independent, generalized logarithmic" or PIGLOG cost functions. Application of Shephard's Lemma through differentiation of the logarithmic cost function with respect to a logarithmic price yields budget (expenditure) share equations for each good in the utility function given by,

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln P_j + \beta_i \ln \left(\frac{X}{P}\right) \quad (1)$$

where X is total expenditure on the group of goods being analyzed, P is the price index for the group, P_j is the price of the *j*th good within the group, w_i is the share of total expenditure allocated to the *i*th good (*i.e.* $w_i = P_iQ_i / X$), and the price index (P) is defined as

$$\ln P = \alpha_0 + \sum_j \alpha_j \ln (P_j) + \frac{1}{2} \sum_j \sum_i \gamma_{ij} \ln P_i \ln P_j \quad (2)$$

Linear homogeneity of the cost function, symmetry of the second–order derivatives, and adding–up across the share equations implies the following set of (equality) restrictions:

$$\sum_{i=1}^{n} \alpha_i = 1; \sum_{i=1}^{n} \gamma_{ij} = \sum_{i=1}^{n} \gamma_{ji} = 0; \sum_{i=1}^{n} \beta_i = 0 \quad (3)$$

As the basic AIDS model is inherently non-linear, to avoid the empirical difficulties, it is common to use Stone's (geometric) price index (P*) instead of P given by,

$$\ln P^* = \sum_k w_k \ln P_k \quad (4)$$

The model that uses Stone's index is called the "Linear Approximate AIDS" (LA/AIDS) following Blanciforti and Green (1983). When the prices are highly collinear, P may be approximately proportional to P*. In the extreme case when P is exactly (linearly) proportional to P*, the LA/AIDS model can be used to estimate the parameters of the AIDS model because, then, the LA/AIDS can be written (in terms of the AIDS model parameters) as

$$w_i = (\alpha_i - \beta_i \ln \zeta) + \sum_j \gamma_{ij} \ln P_j + \beta_i \ln \left(\frac{X}{P^*}\right) \quad (5)$$

More generally, however, the relationship between the parameters of the AIDS and the corresponding parameters of the LA/AIDS is not known.' In addition, it is not known whether the LA/AIDS has satisfactory theoretical properties. These issues notwithstanding, the LA/AIDS is very popular (Green and Alston, 1990). Using the estimates obtained from the model, different elasticities can be obtained through,

– Own price elasticaly $E_{ii} = -1 + \frac{b_{ii}}{w_i} - c_i$;

– Cross price elasticity $E_{ij} = \frac{b_{ij}}{w_i} - \frac{c_i}{w_i} w_j$;

– Income elasticity $\eta_i = 1 + \frac{c_i}{w_i}$;

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

General characteristics of samples households :

Demographic pattern :

The details of demographic pattern of the sample are presented in the Table 1. It could be seen from the table that the female accounts major share (51.32 %) to the total population, among them 58.09 per cent were non-adults whereas it was 41.90 per cent for men.

Education :

The details of education level of the sample are presented in the Table 2 shows that nearly 16.91 per cent of female were illiterates and only 1.47 per cent did their studies upto graduation whereas it was 7.75 per cent and 8.53 per cent, respectively while considering men.

Employment :

It could be seen from the Table 3 that females get employed more days (250 days) in agriculture while compared to men (200 days) and their wage was Rs. 150 and Rs. 250, respectively. Further the average salary of people who are involved in non agricultural occupation was higher (Rs. 400) than the people who occupied in

agriculture with more number of days which clearly states that people who involved in non-agricultural occupation get better employment and income.

Asset holdings :

Asset holding of the sample households is presented in Table 4.

The results (Table 4) revealed that the farmers in the sample were small farmers and their average land holding was 2 acre. While considering the livestock all the farmers had livestock with the average of 4 (numbers) whereas it was 2 (numbers) for agricultural labourers and out of 21 only 12 had livestock's.Further 93 per cent of households had government subsidized television whereas it was 100 per cent and 55 per cent for Grinder and Stove, respectively.

The estimated parameters of the AIDS model for the participants are presented in Table 5. It could be observed from the table that, except cereals, the co-efficients of expenditure of all other food items *viz.*, pulses, fruits and vegetables, oil, milk, meat, sugar and salt are significant, among them pulses, oil, milk and sugar had negative sign whereas vegetables, fruits and meat had positive sign. Food items with positive expenditure co-efficient implies that they are income elastic whereas opposite is true (income inelastic) while considering food items with negative expenditure co-efficient.

Expenditure system – Econometric results (AIDS):

Parameters estimates of almost ideal demand system for food items :

Further the result revealed that the price co-efficient of cereals, vegetables, fruits, spices, milk and meat in cereals equation are significant, among them except cereals all others had negative sign implies that if the prices of vegetables, fruits, spices milk and meat increases would decrease the expenditure share on cereals. While considering pulses equation except cereal and vegetables all other food items had significant price co-efficients, among them pulses and milk had positive price co-efficient and rest of them had negative price co-efficients implying that as the price of pulses and milk

Table 1 : Demographic pattern of sample households (Numbers)

Population	Adults	Non-Adults	Total
Male	85 (53.12)	44 (41.90)	129 (48.67)
Female	75 (46.87)	105 (58.09)	136 (51.32)
Total	160 (60.37)	105 (39.63)	265 (100)

Table 2: Education level of sample households (Numbers)

Education (Numbers)	Illiterate	Primary Schooling	Middle Schooling	High Schooling	Graduation	Total
Male	10 (7.75)	23 (17.83)	38 (29.46)	47 (36.43)	11 (8.53)	129 (100)
Female	23 (16.91)	45 (33.09)	33 (24.26)	33 (24.26)	2 (1.47)	136 (100)
Total	33 (12.5)	68 (25.66)	71 (26.79)	80 (30.19)	13 (4.91)	265 (100)

Table 3 : Employment status of sample households (Days)

Employment	Male		Female	
	Days	Wage	Days	Wage
Farmers	300	-	300	-
Agrl. labourers	200	250	250	150
Non-agrl. labourers	300	400	300	120
Average	267	325	283	135

Table 4 : Asset holding of the sample households (Numbers)

Asset holding	Land (Acre)	Livestock	House	Vehicle	Jewelry	TV	Grinder	Stove	Furniture
Farmers	32 (2)	32 (4)	32 (1)	32 (1)	32 (3)	32 (30)	32 (32)	32 (18)	32 (6)
AL	0 (0)	12 (2)	21 (1)	21 (1)	21 (2)	21 (21)	21 (21)	12 (11)	21 (3)
NA	2 (2)	0 (0)	7 (1)	7 (1)	7 (3)	7 (5)	7 (7)	7 (4)	7 (6)
Total	34 (2)	44 (2)	60 (1)	60 (55)	60 (2.5)	60 (93)	60 (100)	51 (55)	60 (5)

Note: Figures in the parentheses indicate average value of the particular content (except the total for TV, Grinder and Stove); parentheses of total under TV, Grinder and Stove indicate the percentage of those assets provided by government to the total assets.

increases would results increase in the expenditure share on pulses.

Parameters estimates of almost ideal demand system for non-food items :

The estimated parameters of the AIDS model for the participants are presented in Table .6. It could be seen from the table that the co-efficients of expenditure of all non-food items *viz.*, Clothing, health, education, fuel, electricity, travel and social and religious, among them except fuel and travel all other had negative sign implies that they were income elastic. Further the result revealed that the price co-efficient all the non-food items except fuel in the clothing equation were significant among them except clothing and electricity all other had negative sign implies that if the prices of the items increases results decrease in the expenditure share on clothing.

Own price, cross price and income elasticity's of food Items :

Based on the estimated parameters of AIDS model, the own price and cross price elasticities and elasticity with respect to total expenditure (proxy for income), were estimated and presented in Table 7 and 8, respectively for food and non-items. For food items except oil, the expenditure elasticity for all other commodities (cereals, pulses, vegetables, spices, milk, meat and sugar and salt)are positive. This implied that as income increases the household is sufficiently responsive to increase its consumption of these commodities. For example, one per cent increase in income would lead to increase in consumption of all these commodities. While deliberating the cross price elasticities of cereals with pulses, vegetables, spices, oil, milk, meat and sugar and salt, except pulses and oil all other were found to be negative implying that complementary relationship with each other for the participant's households. On the contrary, the cross price elasticities of cereals with pulses and oil were found to be positive and hence, cereals was a substitute for

Table 5 : Parameters estimates of almost ideal demand system for food items

Food	Cereals	Pulses	Vegetables	Fruits	Spices	Oil	Milk	Meat	Sugar and salt
Cereals	0.1334439**	0.009082	-0.05219**	-0.01297**	-0.02449**	0.011434	-0.01792**	-0.03987**	-0.00651
Pulses	0.0090824	0.054219**	0.010186	-0.0174**	-0.00978*	-0.00807*	0.001855*	-0.02706**	-0.00094
Vegetables	-0.0521938**	0.010186	0.079823**	-0.02187**	-0.01806**	-0.02363**	0.00548	0.02315	-0.00103
Fruits	-0.0129684**	-0.0174**	-0.02187**	0.008359*	0.004844	-0.00274*	0.020276	0.023812*	-0.00631
Spices	-0.0244948**	-0.00978*	-0.01806**	0.004844	0.091957**	-0.01508**	-0.02304**	0.003966**	-0.00958
Oil	0.0114339	-0.00807*	-0.02363**	-0.00274*	-0.01508**	0.068823**	-0.02128**	-0.01663**	0.002279
Milk	-0.0179213**	0.001855*	0.00548	0.020276	-0.02304**	-0.02128**	0.034757**	-0.00491	-0.0034**
Meat	-0.0398671**	-0.02706**	0.02315	0.023812	0.003966*	-0.01663**	-0.00491**	0.034768	0.006705
Sugar and salt	-0.0065148	-0.01304*	-0.00288	-0.00231	-0.01032*	0.007185	0.004784*	0.00277	0.018274
Exp. co-efficient	0.0583061	-0.00069**	0.034041**	0.098892**	-0.08818**	-0.0776**	-0.10141**	0.093326*	-0.01484*
Intercept	-0.2312749	0.04889	-0.12072	-0.73594	0.836875	0.698258	0.946848	-0.5976	0.140187

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 6 : Parameters estimates of almost ideal demand system for non-food items

Non-food	Clothing	Health	Education	Fuel	Electricity	Travel	Social and reli
Clothing	0.167474**	-0.0162**	-0.0181**	-0.0981**	0.001844	-0.01333**	-0.0236**
Health	-0.0162**	0.064585**	-0.00826	-0.04263**	-0.00316	-0.00029	0.005789
Education	-0.0181**	-0.00826	0.121617**	-0.06095**	-0.00203	-0.01613**	-0.01602**
Fuel	-0.0981	-0.04247	-0.06095**	0.247722**	-0.01227*	0.001921**	-0.0357**
Electricity	0.001844**	-0.00316	-0.00203	-0.01227*	0.021196	-0.00131	-0.00373
Travel	-0.01333**	-0.00029	-0.01613**	0.001921*	-0.00131	0.041381*	-0.01248**
Social and reli	-0.0236**	0.005789	-0.01615**	-0.0357**	-0.00373	-0.01224**	0.085748**
Exp. co-efficient	-0.11434**	-0.01161**	-0.07426**	0.239726**	-0.01952**	0.047464*	-0.06747**
Intercept	1.337586	0.235137	1.101393	-2.38797	0.230958	-0.39031	0.873212

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 7 : Own price, cross price and income elasticity's of food items

Food-item	Cereals	Pulses	Vegetables	Fruits	Spices	Oil	Milk	Meat	Sugar and salt
Cereals	-0.5073	0.2359	-0.3753	-0.42527	-0.0283	0.5410	0.0611	-0.3512	-0.1639
Pulses	0.0280	-0.7676	0.0549	-0.24505	-0.0571	-0.0900	0.0536	-0.1726	-0.0201
Vegetables	-0.2542	0.2626	-1.3581	-0.43538	-0.0349	-0.1992	0.2006	0.0456	0.0763
Fruits	-0.0744	-0.4422	-0.1542	-1.24827	0.1130	0.0714	0.2676	0.0883	-0.2823
Spices	-0.1277	-0.2474	-0.1355	-0.07012	-1.1334	-0.1163	-0.1088	-0.0357	-0.4458
Oil	0.0337	-0.2049	-0.1585	-0.09524	-0.0918	-0.7177	-0.1437	-0.1228	0.1746
Milk	-0.1001	0.0492	0.0110	0.109762	-0.1217	-0.2299	-1.0635	-0.0846	-0.1006
Meat	-0.2074	-0.6871	0.1061	0.071669	0.1777	-0.0506	0.2100	-1.3174	1.1751
Sugar and salt	-1.2095	-0.3322	-0.0216	-0.04683	-0.0791	0.1533	0.0606	0.0062	.0416
Income	1.2407	0.9824	1.2114	2.139072	0.2022	-0.3888	0.0668	1.5247	0.1658

Table 8 : Own price, cross price and income elasticity's of non-food items

Non-food	Clothing	Health	Education	Fuel	Electricity	Travel	Social and reli
Clothing	0.253233	-0.1634	-0.030888	-0.52539	0.206696	-0.18532	-0.09385
Health	-0.04119	-0.26013	-0.007215	-0.25172	-0.06246	-0.04106	0.080778
Education	0.057595	-0.06274	-0.402294	-0.45958	0.109701	-0.24785	-0.0024
Fuel	-0.46977	-0.4457	-0.181213	-0.26372	-0.32056	-0.09241	-0.12746
Electricity	0.030275	-0.0326	-0.00146	-0.06987	-0.05115	-0.02188	-0.01504
Travel	-0.00543	0.01108	-0.034409	-0.09593	0.03614	-0.66983	-0.03493
Social and reli	-0.04716	0.08435	-0.022918	-0.27829	-0.03887	-0.17481	-0.34413
Income	0.222449	0.86909	0.6803977	1.944504	0.144209	1.43315	0.537041

both pulses and oil.

While deliberating non-food items the expenditure elasticity for all non-food items were positive which implies that as income increases the household is sufficiently responsive to increase its consumption of these commodities. Further it was found that the cross price elasticities of education with all non-food items (clothing, health, fuel, electricity travel and social and religious) was found to be negative implies that they had complementary relation with education similarly fuel also had complementary relation with all other non-food items.

Conclusion :

For food items except oil, the expenditure elasticity for all other commodities (cereals, pulses, vegetables, spices, milk, meat and sugar and salt) are positive, where fruits had highest income elasticity (2.13) followed by meat (1.52), cereals (1.24) and vegetables (1.21). This implied that as income increases the household is sufficiently responsive to increase its consumption of these commodities. Though these commodities are income elastic, the calorie intake with relation to income elasticity is found to be less than one (0.94) which implies that the calorie intake is income inelastic. Therefore, the study revealed that the income transfer programme will not result nutrient improvement of the poor rather they substitute away from calorie toward non-nutrient characteristics of foods such as taste and variety.

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