Sankhyā : The Indian Journal of Statistics
1986, Volume 48, Series B, Pt. 1, pp. 115-143.

CONSUMER EXPENDITURE PATTERN IN INDIA: A COMPARISON OF THE ALMOST IDEAL DEMAND SYSTEM AND THE LINEAR EXPENDITURE SYSTEM

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SUMMARY. In this paper an attempt has been made to compare the performance of the Linear Expenditure System (LES) with that of the Almost Ideal Demand System (AIDS) on Indian consumer expenditure data for the rural and the urban sectors separately. The comparison has been made with particular reference to the income and price elasticities estimated from the two models. In view of the fact that the LES based estimates of the price elasticities are restricted due to the additivity of the direct utility function, the comparison with AIDS would bring out the qualities of the LES based elasticity estimates.

1. Introduction

While statistical analysis of consumer expenditure pattern in India has mostly been confined to Engel curve analysis of budget data collected from nationwide samples of households in different rounds of the National Sample Survey (NSS), there have also been some attempts to estimate complete system of demand equations based on time series data on consumer expenditure and prices. These studies, with a few exceptions, are based on the Linear Expenditure System (LES)—a system that has been very popular with demand analysts because of its ability to formalise consumer behaviour in a simple manner.[1]

As is well known, the LES or for that matter any other system of demand equations based on the assumption of additive separability of underlying direct or indirect preference function achieves the simplicity of the functional form of demand equations in terms of number of parameters at a cost. The assumption of additive separability of the preference function implies a structure of relationship between the income elasticity and the non-compensated price elasticity of different commodities. Specifically, while under direct

AMS (1980) *subject classification :* 62P20.

Key words and phrases : Consumer expenditure pattern, income and price elasticities, the Linear Expenditure System, the Almost Ideal Demand System.

[1]Applications of the LES to Indian data include studies by Rudra (1964), Rudra and Paul (1964), Bhattacharya (1967), Joseph (1968), Radhakrishna and Murthy (1973), Murthy (1977, 1978), Radhakrishna, Murthy and Shah (1979), and Radhakrishna and Murthy (1980).

additivity the own-price elasticity of a commodity becomes approximately proportional to the corresponding income elasticity, indirect additivity imposes a linear relationship between these two elasticities (Deaton, 1974)

The empirical implication of these relationships between income and own price elasticity of commodities is somewhat disturbing. Given that in most cases the time series data on item expenditures and total expenditure are highly correlated, the income responses and hence the income elasticities are more or less accurately estimated and the type of relationships between income and own-price elasticity mentioned above induces a structure on the estimates of the latter vis-a-vis the former. The resulting estimates of own price elasticity thus could be different from what might be obtained on the basis of less restrictive functional forms (for which no such apriori restrictions on the own price elasticities are implied). It is thus important to see the extent to which the estimates of own price elasticities based on the LES or similar systems differ from those based on a flexible system of demand equations [2]

Recently, Deaton and Muellbauer (1980) have proposed a system, which they have called the Almost Ideal Demand System (AIDS). This system has many desirable properties, viz., flexibility of the functional form, consistency in respect of aggregation over consumers, a general form of indirect preference function, and simplicity from the point of view of estimation In what follows, we have made an attempt to compare the performance of the LES with that of the AIDS on the basis of Indian consumer expenditure data [3] This comparison, among other things, would bring out the qualities of the LES-based estimates of the income and price elasticities.

The format of presentation is as follows : Section 2 briefly describes the data used in the present analysis ; Section 3 presents the models and the estimation procedure, Section 4 discusses the results, and finally, Section 5 draws the conclusion.

2. The data

The basic material for the present analysis, viz., time series of estimated per capita consumer expenditure on items and the corresponding total consumer expenditure separately for rural and urban households have been taken from the published reports of NSS 7-28th round (excluding the 26th round

[2]Deaton (1974) reports such a comparison of the estimated own price elasticities based on the LES, a non additive extension of the LES and the constant elasticity demand equations.

[3]The AIDS has also been applied to Indian data by Ray (1980, 1982), and Murthy (1985

for which the estimates are not available)[4] This analysis thus covers the period from October 1953-March 1954 (NSS 7th round) to October 1973-June 1974 (NSS 28th round).

The nine groups of items for which expenditure pattern is analysed are : (*i*) cereals and cereal substitutes, (*ii*) milk and milk products, (*iii*) edible oils, (*iv*) meat, fish and egg, (*v*) sugar etc., (*vi*) other food items (i.e. spices, salt, beverages, prepared food etc.), (*vii*) clothing, (*viii*) fuel and light, and finally (*ix*) other non-food items (which include items like medicine, personal care, education, transport, recreation, rents and taxes etc.).

The analysis has been carried out at two levels of aggregation, viz., one with the itemswise estimates of average per capita expenditure for all households in each round, and another at a somewhat disaggregated level in which for each round estimates of average per capita expenditure for three ordinal groups of population, namely the poorest 30 per cent, the middle 40 per cent and the richest 30 per cent (based on ranking by the level of per capita total consumer expenditure) have been used. For all the rounds, the itemwise estimates of average per capita expenditures by monthly per capita expenditure classes are available from NSS reports. These data have been summarised into the data for the three population groups mentioned above. However the averages for these three population groups have been used together along with the same price vector in estimation of a single system.

The price data used in the present analysis are same as those used in Radhakrishna, Murthy and Shah (1979). The time series of average price indices for each of the nine groups of items mentioned above corresponding to different NSS rounds have been constructed separately for rural and urban India. Actually, the regularly published wholesale price relatives for a large number of individual items/itemgroups belonging to a broad group of items have been averaged to yield the group index in which the expenditure proportions obtained from the NSS 13th round have been used as weights. Separate weighting diagrams have been used for rural and urban India to construct separate price series for the two sectors. Since no other satisfactory retail price series is readily available, the series thus constructed may be taken as a proxy for the actual retail price movements. It should also be pointed out here that the price data so constructed is assumed to be applicable to households belonging to different levels of real per capita consumer expenditure, an assumption which is not strictly valid as some amount of price differentials is known to exist across households having different levels of living.

[4] It may be mentioned here that the estimates of expenditure from different rounds of NSS are more or less comparable being based on similar concepts, definitions and procedures.

3. The LES and the AIDS specification and estimation

The LES, developed by Stone (1954) and subsequently used in numerous empirical applications is a well-known system of demand equations. The form of the demand equation for an individual commodity i is given by

$$p_i q_i = p_i c_i + b_i(y - \sum_k p_k c_k),\ i = 1, \ldots\ldots n \qquad \ldots \quad (3.1)$$

with $$y > \sum_k p_k c_k,\ 0 < b_i < 1,\ \sum_i b_i = 1 \qquad \ldots \quad (3.2)$$

where

n : number of commodities ;

y : total expenditure of the consumer ;

p_i : price of ith commodity ;

q_i : quantity of ith commodity consumed ;

b_i ($i = 1, 2, \ldots\ldots, n$) and c_i ($i = 1, 2, \ldots\ldots, n$) are the parameters of the system. These parameters are sometimes interpreted as follows : c_i is the committed quantity of the i-th item in view of the fact that $q_i = c_i$ when $y = \sum_k p_k c_k$. c_i's are also called the subsistence level of consumption ; $(y - \sum_k p_k c_k)$ is thus the supernumerary income and is allocated among the items in proportions b_1, b_2, ..., b_n. Therefore, b_i's are called the 'marginal budget shares'. This system, by construction, satisfies the theoretical properties, viz. homogeneity of the demand equations in prices and income and symmetry of the compensated cross price effects. The expressions for the income elasticity and uncompensated own and cross price elasticities for the system are

$$\eta_i = b_i / w_i \qquad \ldots \quad (3.3)$$

$$\eta_{ij} = \delta_{ij} - (b_i - \delta_{ij}) \frac{p_j c_j}{p_i q_i}. \qquad \ldots \quad (3.4)$$

Here η_i and η_{ij} are income elasticity for commodity i and the uncompensated price elasticity between commodity i and j respectively. w_i being the Engel ratio for commodity i, and δ_{ij} is the Kronecker delta.[5]

The AIDS, proposed by Deaton and Muellbauer (1980) has the following budget share equation for an individual commodity i.

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log\left(\frac{y}{P}\right) \qquad (3.5)$$

$$i = 1, 2 \ldots\ldots, n$$

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[5]The relationship between η_{ii} and η_i as pointed out by Deaton (1974) is given by $\eta_{ii} = \phi\, \eta_i$, where the constant of proportionality ϕ is interpreted as elasticity of marginal utility of income with respect to income.

with $$\log \overline{P} = \alpha_0 + \Sigma_j \alpha_j \log p_j + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \gamma_{jk} \log p_j \log p_k \quad \ldots \quad (3.6)$$

The parameters of the system are α_i ($i = 1, 2, \ldots, n$), β_i ($i = 1, 2, \ldots, n$) and γ_{ij} ($i, j = 1, 2, \ldots, n$). $\overline{P}$ is a measure of price level used to deflate money expenditure y. The adding up property implies

$$\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \beta_i = 0, \sum_{i=1}^{n} \gamma_{ij} = 0. \quad \ldots \quad (3.7)$$

This system has several advantages. First, the functional form (3.5) is flexible enough to approximate any true demand system underlying a given data fairly satisfactorily ; secondly, equation (3.5) being a member of the class of Price Independent Generalised Linear (PIGL) budget share equations proposed by Muellbauer (1975), it can be consistently aggregated over individuals ; thirdly, the indirect utility function underlying equation (3.5) is of a general form so that one can use this system to test empirically the theoretical restrictions on consumer behaviour, viz., homogeneity and symmetry for given data through imposing simple restrictions on the parameters.[6]

The expressions for the income elasticities and non compensated cross price elasticities for the AIDS are given by

$$\eta_i = 1 + \beta_i / w_i, \quad i = 1, 2, \ldots, n \quad \ldots \quad (3.8)$$

$$\eta_{ij} = \frac{1}{w_i} \left[\gamma_{ij} - \beta_i \left(\alpha_j + \sum_{k=1}^{n} \gamma_{kj} \log p_k \right) \right] - \delta_{ij} \; i, j = 1, \ldots, n \quad \ldots \quad (3.9)$$

Coming to the estimation of these systems, in the present analysis more or less the standard procedures for estimation have been applied. More specifically, for the LES we have used the following additive stochastic specification

$$w_{it} = \frac{p_{it} c_i}{y_t} + b_i \left(1 - \sum_{k} \frac{p_{kt} c_k}{y_t} \right) + u_{it}, \; i = 1, 2, \ldots, n \quad \ldots \quad (3.10)$$

$$t = 1, 2, \ldots, T$$

where subscript t refers to the observation and the disturbance terms u_{it}'s are assumed to have

$$E(u_{it}) = 0 \text{ for all } i, t \quad \ldots \quad (3.11)$$

and $$E(u_{it} u_{jt}) = \begin{cases} \sigma_{ij} & \text{for } t = s \\ 0 & \text{for } t \neq s. \end{cases}$$

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[6]Homogeneity can be tested by imposing $\sum_{j=1}^{n} \gamma_{ij} = 0$ for all i, and symmetry can be tested by imposing $\gamma_{ij} = \gamma_{ji}$ for all i, j.

The contemporaneous covariance matrix of the disturbances $\Omega = [\sigma_{ij}]$ is singular here because of the adding-up criterion. Under the assumption of multivariate normality of u's, the log-likelihood function can be maximised by standard Non Linear Full Information Maximum Likelihood (NLFIML) method with provision for handling the singularity of Ω.[7]

For the AIDS with an additive disturbance specification, viz.,

$$w_{it} = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_{jt} + \beta_i \log\left(\frac{y_t}{P_t}\right) + u_{it}, \quad i = 1, \ldots, n \qquad (3.13)$$
$$t = 1, \ldots, T$$

where P_t relates to (3.6) above, one can estimate the parameters by standard non linear full information maximum likelihood method

However, in view of a large number of parameters being involved in this estimation, the actual estimation may be computationally heavy. Indeed, Deaton and Muellbauer (1980) suggested a simpler equation-by-equation Ordinary Least Squares (OLS) method of estimation of equation (3.13), based on the following approximation of P_t.

$$\log P_t \simeq \sum_{k=1}^{n} w_{kt} \log p_{kt}, \quad t = 1, \ldots, T \qquad (3.14)$$

where the right hand side of (3.14) is a logarithmic price index used in Stone (1953).[8] Given this approximation, OLS estimation of (3.13) is straight forward, and one can even have the homogeneity constrained estimates of the parameters of AIDS by imposing $\sum_{j=1}^{n} \gamma_{ij} = 0$ for each equation separately, and then using restricted OLS method

4. Results

4.1. *Parameter estimates.* Table 1 presents the parameter estimates along with the corresponding asymptotic standard errors of the LES separately for rural and urban India for both aggregate and disaggregated data. The 'b' and 'c' parameters are significant in most cases with a few exceptions on both sets of data for rural and urban India. In some cases the 'c' parameters are negative and for these 'c' 's the interpretation of 'committed' quantity does not hold. However, a negative c is not inconsistent with the theory.

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[7] We are grateful to Prof. Angus Deaton for providing us with the computer program which has been used to estimate the LES by NLFIML.

[8] For justification of using this formula as an approximation, see Deaton and Muellbauer (1980).

TABLE 1 : PARAMETER ESTIMATES OF THE LES : ALL INDIA-RURAL AND URBAN (7TH-28TH ROUND NSS)

items	aggregate data				disaggregated data			
	rural		urban		rural		urban	
	b	c	b	c	b	c	b	c
1. Cereals and cereal substitutes	0.245 (0.027)*	5.140 (0.272)	0.117 (0.010)	3.782 (0.275)	0.270 (0.010)	4.210 (0.121)	0.096 (0.008)	4.281 (0.104)
2. Milk and milk products	0.115 (0.021)	0.234 (0.215)	0.115 (0.014)	0.045 (0.266)	0.117 (0.003)	−0.099 (0.042)	0.127 (0.002)	−0.298 (0.058)
3. Edible oils	0.029 (0.003)	0.182 (0.014)	0.017 (0.002)	0.457 (0.019)	0.030 (0.001)	0.115 (0.008)	0.035 (0.001)	0.171 (0.015)
4. Meat, fish, egg	0.043 (0.003)	0.033 (0.016)	0 041 (0.003)	0.021 (0.015)	0.030 (0.001)	0.070 (0.008)	0.038 (0.001)	0.042 (0.013)
5. Sugar	0.027 (0.003)	0.235 (0.016)	0.020 (0.003)	0.321 (0.033)	0.038 (0.001)	0.052 (0.012)	0.023 (0.001)	0.141 (0.018)
6. Other food	0.138 (0.020)	0.867 (0.164)	0.151 (0.029)	1.115 (0.476)	0.125 (0.005)	0.895 (0.045)	0.179 (0.006)	0.457 (0.089)
7. Clothing	0.118 (0.063)	0.284 (0.227)	0.117 (0.016)	−0.844 (0.531)	0.124 (0.005)	−0.128 (0.053)	0.092 (0.003)	−0.417 (0.057)
8. Fuel and light	0.083 (0.010)	0.298 (0.105)	0.039 (0.006)	0.304 (0.108)	0.042 (0.001)	0.686 (0.017)	0.046 (0.001)	0.540 (0.022)
9. Other non food	0.204 (0.031)	0.704 (0.317)	0.363 (0.043)	−0.881 (1.439)	0.223 (0 009)	−0 095 (0.104)	0.358 (0.009)	−1.289 (0.226)

* asymptotic standard errors.

A comparison of parameters between the aggregate and disaggregated data shows that the 2σ intervals of the parameters from the two sets of data overlap in majority of the cases, thus implying that the two sets of parameters are broadly equal. On the assumption that the parameters of the LES are the same for the three population groups this is to be expected in view of the fact that the LES is consistent with perfect linear aggregation (see however, below).

Tables 2.1 and 2.2 present the parameter estimates and the corresponding asymptotic standard errors for AIDS fitted to aggregate data for rural and urban India respectively, and Tables 2.3 and 2.4 present the above estimates for disaggregated data. On aggregate data, out of ninetynine parameters, in the rural sector, fourteen have t-values exceeding 2, and thirtyfive parameters have t-values between 1 and 2. In the urban sector, twentytwo parameters have t-values exceeding 2, and thirtyseven have t-values between 1 and 2.

On the disaggregated data, for both rural and urban India almost all the estimated α and β parameters have t-values much larger than 2. In the rural sector, for sixteen out of eightyone γ-parameters, the t-values exceed 2, and for twentyfour parameters the t-values lie between 1 and 2. In the urban sector the corresponding number of parameters are eleven and twentytwo respectively.

One would expect the parameter estimates of AIDS for aggregate and disaggregated data to be close if the same system holds for all three population groups in view of the fact that the distribution of expenditures remained almost constant over the period of NSS rounds covered in this study. The results presented in Tables 2.1-2.4 support this fact. In the rural sector, ninetythree out of ninetynine parameters have overlapping 2σ intervals between the aggregate and disaggregated data. In the urban sector the number of such parameters is ninetyeight.

The 2σ interval comparison of the estimated parameters of the LES and the AIDS discussed above tends to reject the hypothesis of equality only when the divergence is very large. It is not strictly correct even under the assumption that a single system is applicable to all the three population groups. Thus, it is of interest to examine this crucial assumption through some direct and rigorous test. For the AIDS, homogeneity across population groups has been tested for individual item groups through a single equation procedure described in Deaton (1980). Following this procedure, population group-specific observations are first standardised by dividing by the respective

TABLE 2.1 : PARAMETER ESTIMATES OF AIDS FITTED TO AGGREGATE DATA.

ALL INDIA—RURAL (7TH-28TH ROUND NSS)

Items	parameters										
	α_i	β_i	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	γ_{i6}	γ_{i7}	γ_{i8}	γ_{i9}
1. Cereals and cereal substitutes	0.585 (0.205)*	−0.053 (0.071)	0.265 (0.008)	−0.153 (0.074)	−0 030 (0.048)	−0.024 (0.031)	−0.014 (0.021)	−0.006 (0 035)	0.043 (0.067)	−0.027 (0.060)	−0.031 (0.036)
2. Milk an Milk products	0.149 (0.140)	−0.025 (0.049)	−0.049 (0.046)	0.006 (0.050)	−0.001 (0.033)	0.028 (0.021)	−0.009 (0.015)	−0.007 (0.038)	−0.048 (0.045)	0.000 (0.047)	−0.005 (0.025)
3. Edible oils	0.067 (0.031)	−0.014 (0.011)	−0.012 (0.010)	0.005 (0.011)	0.014 (0.007)	0.009 (0.005)	−0.005 (0.003)	−0.012 (0.008)	−0.011 (0.010)	0.005 (0.009)	0.001 (0.006)
4. Meat, fish, egg	0.053 (0.027)	−0.011 (0.009)	−0.039 (0.009)	0.021 (0.010)	0.016 (0.006)	0.007 (0.004)	0.003 (0.003)	−0.008 (0.007)	-0.012 (0.009)	0.009 (0.008)	−0.000 (0 005)
5. Sugar	0.052 (0.024)	−0.008 (0.008)	−0.007 (0.008)	0.014 (0.009)	−0 003 (0.006)	0.001 (0.004)	0.017 (0.002)	−0.010 (0.006)	−0.008 (0.008)	−0.004 (0.007)	0.007 (0.004)
6. Other food	0.141 (0.119)	−0.010 (0.041)	−0.091 (0.039)	0.058 (0.043)	0.052 (0.028)	0.021 (0.018)	0.015 (0.012)	−0.026 (0.032)	−0.102 (0.038)	0.011 (0.035)	−0.011 (0.021)
7. Clothing	−0.115 (0.150)	0.007 (0.052)	−0.036 (0.050)	−0.014 (0.054)	0.009 (0.035)	−0.031 (0.023)	−0.001 (0.016)	0.026 (0.040)	0.096 (0.049)	0.016 (0.044)	−0.017 (0.027)
8. Fuel and light	0.018 (0.053)	−0.007 (0.018)	−0.033 (0.017)	−0.010 (0.019)	0.006 (0.012)	0.001 (0.008)	−0.001 (0.006)	0.012 (0.014)	−0.001 (0.017)	0.026 (0.016)	−0.012 (0.009)
9. Other non food	−0.013 (0.200)	0.001 (0.069)	0.002 (0.066)	0.015 (0.072)	−0.074 (0.047)	−0.010 (0.030)	−0.005 (0.021)	0.032 (0.054)	0.045 (0.065)	−0.035 (0.059)	0.074 (0.035)

* asymptotic standard errors

TABLE 2.2: PARAMETER ESTIMATES OF AIDS FITTED TO AGGREGATE DATA; ALL INDIA—URBAN (7TH—28TH ROUND NSS)

Items	parameters										
	α_i	β_i	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	γ_{i6}	γ_{i7}	γ_{i8}	γ_{i9}
1. Cereals and cereal substitutes	0.737 (0.270)*	−0.152 (0.085)	0.014 (0.078)	−0.030 (0.086)	−0.050 (0.046)	−0.024 (0.029)	−0.012 (0.048)	−0.004 (0.034)	0.097 (0.072)	0.056 (0.097)	−0.117 (0.165)
2. Milk and milk products	0.018 (0.104)	0.026 (0.033)	−0.042 (0.030)	0.054 (0.033)	−0.008 (0.017)	0.045 (0.011)	−0.002 (0.018)	−0.000 (0.013)	−0.060 (0.028)	0.004 (0.033)	−0.044 (0.064)
3. Edible oils	0.059 (0.036)	−0.008 (0.012)	0.014 (0.011)	−0.020 (0.012)	0.010 (0.006)	0.006 (0.004)	−0.016 (0.006)	−0.004 (0.005)	0.005 (0.010)	−0.022 (0.013)	0.045 (0.022)
4. Meat, fish, egg	0.039 (0.049)	−0.002 (0.016)	−0.031 (0.014)	0.016 (0.016)	0.015 (0.008)	0.007 (0.005)	0.012 (0.008)	−0.003 (0.006)	−0.023 (0.013)	0.038 (0.018)	−0.061 (0.030)
5. Sugar	0.088 (0.034)	−0.017 (0.011)	0.010 (0.010)	−0.001 (0.011)	−0.017 (0.006)	−0.004 (0.004)	0.005 (0.006)	−0.015 (0.004)	0.030 (0.009)	−0.036 (0.012)	0.061 (0.021)
6. Other food	0.509 (0.237)	−0.109 (0.076)	−0.081 (0.069)	0.094 (0.076)	0.070 (0.040)	0.004 (0.026)	−0.009 (0.040)	−0.026 (0.030)	−0.135 (0.063)	−0.155 (0.085)	0.275 (0.145)
7. Clothing	−0.251 (0.142)	0.097 (0.045)	−0.070 (0.041)	0.004 (0.046)	0.040 (0.024)	0.015 (0.015)	0.070 (0.024)	−0.002 (0.018)	−0.031 (0.038)	0.176 (0.051)	−0.319 (0.087)
8. Fuel and light	0.115 (0.046)	−0.016 (0.015)	−0.011 (0.013)	0.006 (0.015)	−0.007 (0.008)	0.000 (0.005)	−0.007 (0.008)	−0.003 (0.006)	0.004 (0.012)	0.006 (0.017)	0.003 (0.029)
9. Other non food	−0.314 (0.267)	0.182 (0.081)	0.090 (0.074)	−0.124 (0.081)	−0.032 (0.043)	−0.053 (0.028)	−0.042 (0.044)	0.001 (0.032)	0.114 (0.069)	−0.068 (0.092)	0.158 (0.157)

* asymptotic standard errors.

TABLE 2.3: PARAMETER ESTIMATES OF AIDS FITTED TO DISAGGREGATED DATA ALL INDIA—RURAL (7TH—28TH ROUND NSS)

Items	parameters										
	α_i	β_i	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	γ_{i6}	γ_{i7}	γ_{i8}	γ_{i9}
1. Cereals and cereal substitutes	1.001	−0.192	0.208	−0.086	−0.018	−0.030	0.011	0.048	0.047	0 078	0.018
	(0.022)*	(0.005)	(0.076)	(0.080)	(0.054)	(0.033)	(0.025)	(0.053)	(0.070)	(0 005)	(0.043)
2. Milk and milk products	−0.082	0.053	−0.031	0.024	−0.007	0.016	−0.011	0.016	−0.026	0.023	−0.010
	(0.007)	(0.002)	(0.025)	(0 027)	(0.018)	(0 011)	(0.008)	(0.018)	(0 026)	(0.022)	(0.014)
3. Edible oils	0.027	0.000	−0.010	0.004	0.013	0.011	−0.007	−0.009	−0.012	0 008	−0.003
	(0.003)	(0.001)	(0.008)	(0.009)	(0.006)	(0.004)	(0.003)	(0.006)	(0.009)	(0 007)	(0.005)
4. Meat, fish, egg	0.010	0.004	−0 026	0.017	0 008	0.005	0.001	−0.002	−0.008	0 003	−0.001
	(0.003)	(0.001)	(0.010)	(0.011)	(0 007)	(0.004)	(0.003)	(0.007)	(0.010)	(0 009)	(0.006)
5. Sugar	−0.005	0.011	−0.004	0.005	−0.001	0.002	0.010	−0.012	−0 001	−0.002	0.002
	(0.003)	(0.001)	(0.010)	(0.010)	(0.007)	(0.004)	(0.003)	(0 007)	(0 010)	(0.008)	(0.005)
6. Other food	0.143	−0.010	−0.003	−0.019	0.070	−0.017	0.042	−0.043	−0 020	0.120	0.007
	(0.012)	(0.003)	(0.042)	(0.045)	(0.030)	(0.018)	(0.014)	(0.031)	(0.043)	(0.037)	(0.024)
7. Clothing	−0.094	0.059	−0.026	−0.009	−0.012	−0.023	−0.008	0.025	0 071	0.024	−0.020
	(0.010)	(0.002)	(0.033)	(0.036)	(0.024)	(0.014)	(0.011)	(0.024)	(0 034)	(0.029)	(0.019)
8. Fuel and light	0.135	−0.024	−0.040	−0.003	0.007	0.007	−0.002	0.003	−0.007	0 027	0.014
	(0.004)	(0.001)	(0.012)	(0.013)	(0.009)	(0.005)	(0.004)	(0.009)	(0.012)	(0.010)	(0.007)
9. Other non food	−0.137	0.100	0.020	0.038	−0.001	0.030	−0.042	0.071	−0.035	−0.126	0.034
	(0.026)	(0.006)	(0.085)	(0.092)	(0.062)	(0.037)	(0.028)	(0.063)	(0.087)	(0.075)	(0.049)

* asymptotic standard errors.

TABLE 2.4 : PARAMETER ESTIMATES OF AIDS FITTED TO DISAGGREGATED DATA ALL INDIA—URBAN (7TH- 25TH ROUND NSS)

Items	parameter										
	α_i	β_i	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	γ_{i6}	γ_{i7}	γ_{i8}	γ_{i9}
1. Cereals and cereal substitutes	0.908 (0.010)*	−0.196 (0.002)	0.104 (0.043)	−0.032 (0.047)	−0.047 (0.027)	−0.036 (0.018)	−0.017 (0.028)	0.011 (0.020)	0 087 (0.045)	0.115 (0.058)	−0.175 (0.059)
2. Milk and milk products	−0.022 (0.009)	0.037 (0.002)	−0.007 (0.038)	−0.003 (0.012)	−0.026 (0.024)	0.026 (0.010)	−0.010 (0.025)	−0.013 (0.018)	−0.001 (0.041)	−0.010 (0.052)	0.066 (0.059)
3. Edible oils	0.054 (0.004)	−0.006 (0.001)	0.013 (0 010)	−0.023 (0.018)	0.009 (0.010)	0.007 (0.007)	−0.019 (0.011)	−0.005 (0.008)	0.062 (0.017)	−0.018 (0.022)	0.033 (0.038)
4. Meat, fish, egg	0.020 (0.004)	0.004 (0.001)	-0.024 (0.016)	0.016 (0.017)	0.008 (0.017)	0.007 (0.006)	0.005 (0.010)	−0.001 (0.007)	−0.016 (0.016)	0 020 (0.021)	−0.031 (0.036)
5. Sugar	0.042 (0.004)	−0.003 (0.001)	0.009 (0.019)	−0.005 (0.021)	−0.011 (0.012)	−0.002 (0.008)	0.008 (0.013)	−0.018 (0.009)	0.024 (0.020)	−0 044 (0.020)	0.073 (0.046)
6. Other food	0.130 (0.012)	0.009 (0.003)	−0.052 (0.054)	0.004 (0.060)	0 071 (0.035)	−0.003 (0.023)	0.004 (0.035)	−0.011 (0.026)	−0 123 (0.057)	−0 109 (0.074)	0.265 (0.126)
7. Clothing	−0.006 (0.006)	0.038 (0.001)	−0.007 (0.028)	0 021 (0.031)	0.028 (0.018)	0.017 (0.012)	0 046 (0.018)	−0.008 (0.013)	−0.021 (0.030)	0 139 (0.038)	−0.256 (0.065)
8. Fuel and light	0.132 (0.003)	−0.021 (0.001)	−0.019 (0.011)	0,003 (0.012)	−0.006 (0.007)	0.005 (0.005)	−0.002 (0.007)	−0.009 (0.005)	0.006 (0.011)	0.015 (0.015)	0.002 (0.025)
9. Other non food	−0.200 (0 019)	0.138 (0.001)	0.042 (0.061)	−0 010 (0 092)	−0.025 (0.053)	−0.020 (0.035)	−0 [illegible] (0.055)	0 035 (0 040)	0.012 (0.089)	−0.043 (0.114)	0.014 (0.195)

* asymptotic standard errors.

estimated standard deviations obtained from the group-specific regression estimates. A pooled weighted regression equation is then estimated on the basis of these standardised observations. The equation-wise F-statistics are then calculated for the rural and the urban sectors[9]. Table 3.1 presents the itemwise computed F-values separately for rural and urban India. It may be seen from this table that with (22, 27) degrees of freedom, for most of the itemgroups in rural and urban India, the assumption of homogeneity across population groups is rejected at 5 per cent level of significance. Exceptions are 'sugar' for rural India and 'cereals and cereal substitutes', 'other food', 'clothing' and 'fuel and light' for urban India.

TABLE 3.1 : ITEMWISE F-VALUES FOR POOLING TEST BASED ON AIDS

All India—Rural and Urban, disaggregated data (5th-28th round NSS)

Items	All India rural	All India urban
1. Cereals and cereal substitutes	12.034*	0.529
2. Milk and milk products	15.219*	2.338*
3. Edible oils	5.455*	5.795*
4. Meat, fish, egg	2.429*	18.569*
5. Sugar	1.336	7.016*
6. Other food	12.444*	1.735
7. Clothing	5.243*	0.111
8. Fuel and light	11.210*	0.184
9. Other non food	11.001*	2.263*

* significant at 5 per cent level exceeding critical value $F_{22,27} = 1.96$.

For the LES, an approximate pooling test has been done on the basis of the likelihood values.[10] In this case, the system has been estimated separately for each of the three population groups and the sum of twice-log-likelihood values obtained for each population group (called L_s here) has been compared with the corresponding twice-log-likelihood value for the system estimated on the basis of pooled data (called L_p here). The difference $L_s - L_p$

[9] $F = \dfrac{RSS_p - T + 3K}{2K}$. RSS_p being the residual sum of squares for the pooled regression mentioned above, T the total number of observations in all the three groups together, and K the number of parameters in the equation, is distributed as $F(2K, T-3K)$ under the null hypothesis of intergroup homogeneity.

[10] This test procedure followed here is an approximate one, as it does not take into account the heterogeneity of the variances of the itemspecific random disturbances across population groups.

is asymptotically distributed as $\chi^2_{n_s - n_p}$ where $n_s = 3n_p$, n_p being the number of parameters in the system. The estimated $L_s - L_p$ values are presented in Table 3.2, along with the corresponding group-specific and pooled twice-log-likelihood values. The results indicate the heterogeneity of consumption patterns, as described by the LES, across population groups.[11]

TABLE 3.2: DIFFERENCE OF LOG-LIKELIHOOD VALUES FOR ALTERNATIVE ESTIMATION OF THE LES FROM POOLED AND NON POOLED DATA

All India Rural and urban, disaggregated data (7th-28th round NSS)

sector	population group 1	population group 2	population group 3	pooled	$L_s - L_p$*
All India rural	1313.2	1354.0	1306.5	3523.6	480.1
All India urban	1369.6	1347.7	1351.5	3531.7	534.2

* the critical value of χ^2_{24} at 5 per cent level of significance is 51.29

Tables 4.1 and 4.2 present the equation by equation squared correlation coefficients for the two models for aggregate and disaggregated data (separately for the rural and the urban sector) in terms of expenditure and budget share respectively. Clearly, AIDS is superior to LES in all cases.

TABLE 4.1: ITEMWISE SQUARED CORRELATION COEFFICIENTS BETWEEN OBSERVED AND ESTIMATED EXPENDITURE (R^2_i) FOR LES AND AIDS

ALL INDIA RURAL AND URBAN (7TH-28 ROUND NSS)

items	aggregate data				disaggregated data			
	rural		urban		rural		urban	
	LES	AIDS	LES	AIDS	LES	AIDS	LES	AIDS
1. Cereals and cereal substitutes	0.995	0.998	0.987	0.997	0.970	0.992	0.916	0.994
2. Milk and milk products	0.952	0.977	0.985	0.995	0.980	0.985	0.992	0.992
3. Edible oils	0.993	0.996	0.992	0.998	0.974	0.992	0.938	0.990
4. Meat, fish, egg	0.994	0.995	0.985	0.991	0.970	0.982	0.990	0.990
5. Sugar	0.990	0.997	0.988	0.997	0.947	0.983	0.935	0.971
6. Other food	0.987	0.995	0.976	0.995	0.969	0.989	0.948	0.986
7. Clothing	0.874	0.944	0.819	0.953	0.947	0.982	0.941	0.986
8. Fuel and light	0.990	0.994	0.995	0.998	0.980	0.980	0.988	0.993
9. Other non food	0.964	0.984	0.987	0.995	0.948	0.978	0.978	0.993

[11]Although the assumption of equality of parameters across population groups is rejected by the overall tests, a closer examination of the parameter estimates obtained from the three population groups separately reveals that while only some of the parameters vary systematically, the others show small variation across population groups. Refinements taking into account these factors have not, however, been attempted in this paper.

TABLE 4.2. ITEMWISE SQUARED CORRELATION COEFFICIENTS BETWEEN OBSERVED AND ESTIMATED BUDGET SHARES (R^2) FOR LES AND AIDS

ALL INDIA—RURAL AND URBAN (7TH-28TH ROUND NSS)

Items	aggregate data				disaggregated data			
	rural		urban		rural		urban	
	LES	AIDS	LES	AIDS	LES	AIDS	LES	AIDS
1. Cereals and cereal substitutes	0 790	0 967	0.669	0.778	0 881	0.969	0.937	0.995
2. Milk and milk products	0 977	0 418	0.290	0 817	0 900	0.955	0.937	.9000
3. Edible oils	0.823	0.917	0.934	0 984	0.516	0.757	0.450	0 827
4. Meat, fish, egg	0.126	0.810	0.127	0.533	0.477	0.568	0.488	0 407
5. Sugar	0 700	0.953	0.449	0 933	0.671	0.890	0.035	0 511
6. Other food	0.069	0.891	0.597	0.946	0.009	0.039	0.108	0.766
7. Clothing	0 773	0.850	0.014	0 922	0.770	0.943	0.758	0.953
8. Fuel and light	0.462	0.823	0.669	0.803	0.909	0.938	0.894	0.972
9. Other non food	0.786	0.855	0.654	0.927	0.720	0.870	0.841	0.962

4.2. *Elasticities. Expenditure elasticities* : Table 5.1 lists the total expenditure elasticities of the LES and AIDS calculated at the sample average, for aggregate and disaggregated data separately for rural and urban

TABLE 5.1 : ESTIMATES OF ITEMWISE EXPENDITURE ELASTICITIES CALCULATED AT SAMPLE AVERAGE FOR LES AND AIDS

ALL INDIA—RURAL AND URBAN (7TH-28TH ROUND NSS)

Items	aggregate data				disaggregated data			
	rural		urban		rural		urban	
	LES	AIDS	LES	AIDS	LES	AIDS	LES	AIDS
1. Cereals and cereal substitutes	0.579	0.873	0.481	0.363	0.840	0.562	0.387	0.269
2. Milk and milk products	1 563	0.879	1.217	1.281	1.576	1.758	1.331	1.413
3. Edible oils	0.931	0.560	0.422	0.814	0.996	1 008	0.888	0.860
4. Meat, fish, egg	1.707	0.589	1.199	0.939	1.156	1.165	1.104	1.106
5. Sugar	0 883	0.734	0 658	0.396	1.293	1 375	0 942	0 887
6. Other food	1 042	0.929	0.857	0.408	0.945	0.925	1 031	1.049
7. Clothing	1 528	1.944	1 [illegible]	2.477	1.595	1 884	1 450	1 012
8. Fuel and light	1 382	0.882	0.983	0.730	0.950	0.921	0 756	0.675
9. Other non food	1.366	1.432	1.400	1.742	1.518	1.736	1.397	1.589

India. A comparison of the elasticity estimates between the aggregate and the disaggregated data reveals that for both the rural and the urban sector, AIDS shows a much larger discrepancy in the elasticity values than the LES. A plausible explanation of this could be that LES being consistent with exact linear aggregation, the average values of calculated x's in equation (3.3) based on aggregate and disaggregated data do not vary much; and as noted earlier, the parameter values based on the aggregate and disaggregated data being virtually the same, the elasticity values remain almost the same. For AIDS, however, the average values of calculated x's would depend largely on the nature of the data, because AIDS is not consistent with exact linear aggregation. On the other hand, comparison of the two models based on aggregate and disaggregated data separately, shows that, on disaggregated data, in both rural and urban sector, the sets of expenditure elasticities in LES and AIDS are fairly comparable, whereas on aggregate data the picture is different. On urban aggregate data, the two sets of elasticities are more less comparable, but in the rural sector, while 'fuel and light' is highly luxury in LES, in AIDS this is as necessary as 'cereals'. 'milk and milk products' and 'meat, fish, egg' are luxury items with very high elasticity values in LES, whereas both these items are necessaries in AIDS. We have pointed out earlier that the itemwise expenditure and total expenditure data are highly correlated, and so the income elasticities in the LES are more or less accurately estimated. Thus, the AIDS gives more reliable estimates of the income elasticities based on disaggregated data than on aggregate data.

Price elasticities : Tables 5.2-5.5 list the non-compensated own and cross price elasticities for aggregate and disaggregated data respectively for (1) LES fitted to rural data, (2) AIDS fitted to rural data, (3) LES fitted to urban data and (4) AIDS fitted to urban data. Comparison of elasticities of LES between aggregate and disaggregated data in table 5.2 shows that while own price elasticities have the same signs for the two sets of data, twentyfour out of seventytwo cross price elasticities have opposite signs. In AIDS, on rural data (Table 5.3) the number of cross price elasticities having opposite signs in nine. The own price elasticity for 'clothing' turns out to be positive in AIDS on both aggregate and disaggregated data.[11] In the urban sector, the number of price elasticities whose sign do not agree in the aggregate and disaggragated data is eight for LES (Tables 5.4) and nine for AIDS (Table 5.5).

[11]Positive estimate for 'clothing' has been obtained by Bhattacharya and Maitra (1970). They analysed the time series of cross sectional expenditure data for NSS 7th (1953-54) to 22nd (1967-68) rounds on the basis of the log-log-inverse Engel curve modified to incorporate price in a reasonable manner.

TABLE 5.2 : ESTIMATES OF ITEMWISE NON COMPENSATED OWN AND CROSS PRICE ELASTICITIES CALCULATED AT SAMPLE AVERAGE FOR LES

ALL INDIA - RURAL (7TH-28TH ROUND NSS)

Items	1	2	3	4	5	6	7	8	9
1. Cereals and cereal substitutes	−0.474* −0.589**	−0.008 0.004	0.009 −0.006	0.002 −0.003	0.010 −0.002	0.034 −0.030	−0.001 0.004	−0.009 −0.021	−0.025 0.003
2. Milk and milk products	−0.490 −0.374	−0.838 −1.047	−0.025 −0.015	0.004 −0.009	−0.026 0.005	0.093 −0.078	−0.024 0.010	−0.029 −0.031	−0.067 0.008
3. Edible oils	−0.274 −0.230	−0.013 0.006	−0.502 −0.690	−0.003 0.005	−0.015 −0.003	−0.055 −0.046	−0.014 0.007	−0.010 −0.032	−0.040 0.005
4. Meat, fish, egg	−0.503 −0.274	−0.023 0.007	−0.027 −0.011	−0.897 −0.705	−0.028 0.004	−0.101 −0.054	−0.026 0.008	−0.029 −0.038	−0.073 0.006
5. Sugar	−0.280 −0.307	−0.012 0.007	−0.014 −0.013	−0.002 −0.007	−0.470 −0.887	−0.052 −0.061	−0.014 0.009	−0.015 −0.042	−0.038 0.007
6. Other food	−0.307 −0.224	−0.014 0.005	−0.010 −0.009	−0.003 −0.005	−0.017 −0.003	−0.007 −0.050	−0.016 0.006	−0.017 −0.031	−0.044 0.005
7. Clothing	−0.460 −0.378	−0.021 0.009	−0.021 −0.015	−0.004 −0.009	−0.025 −0.006	−0.091 −0.075	−0.823 −1.077	−0.026 −0.052	−0.065 0.008
8. Fuel and light	−0.407 −0.164	−0.019 0.004	−0.022 −0.007	−0.004 −0.004	−0.023 −0.002	−0.082 −0.032	−0.021 0.005	−0.746 −0.403	−0.050 0.003
9. Other non food	−0.402 −0.359	0.018 0.009	−0.022 −0.015	−0.001 −0.008	−0.022 −0.005	−0.081 −0.071	−0.021 0.010	−0.023 −0.049	−0.772 −1.027

* estimates based on aggregate data

** estimates based on disaggregated data.

TABLE 5.3 : ESTIMATES OF ITEMWISE NON COMPENSATED OWN AND CROSS PRICE ELASTICITIES CALCULATED AT SAMPLE AVERAGE FOR AIDS

ALL INDIA—RURAL (7TH–28TH ROUND NSS)

Items	1	2	3	4	5	6	7	8	9
1. Cereals and cereal substitutes	−0.034*	−0.348	−0.063	0.050	−0.027	0.002	0.093	−0.054	−0.069
	−0.088**	−0.233	−0.023	−0.062	0.025	−0.044	0.068	−0.122	−0.021
2. Milk and milk products	−0.472	−0.104	0.004	0.349	0.004	−0.042	−0.650	0.035	−0.053
	−1.170	−0.590	−0.124	0.212	−0.161	0.113	−0.298	0 215	−0.117
3. Edible oils	−0.139	0.208	−0.526	0.312	−0.126	−0.322	−0.385	0.196	0.053
	−0.309	0.118	−0.604	0.328	0.215	−0.288	−0.390	0.262	−0.000
4. Meat, fish, egg	−1.287	0.833	0.580	−0.715	0.118	−0.242	−0.496	0.388	−0.196
	−1.200	0.663	0.300	−0.810	0.053	−0.103	−0.280	0.077	−0.028
5. Sugar	−0.096	0.469	−0.071	0.039	−0.439	−0.298	- 0.288	−0.117	0.218
	−0.486	0.212	−0.055	0.062	−0.402	−0.468	−0.005	−0.112	0.118
6. Other food	−0.613	0.424	0.586	0.160	0.109	−1.178	−0.732	0.082	−0.078
	−0.696	−0.362	0.613	−0.120	0.307	−1.300	−0.216	0.681	0.038
7. Clothing	−0.983	−0.328	−0.192	0.482	−0.050	0.238	0.425	0.147	−0.272
	−1.265	−0.008	−0.221	−0.356	−0.136	0.241	0.162	0.234	−0.265
8. Fuel and light	−0.480	−0.153	0.111	0.025	−0.005	0.204	−0.023	−0.566	−0.194
	−0.240	−0.078	0.127	0.118	−0.024	0.094	−0.154	−0.529	−0.285
9. Other non food	−0.208	0 047	−0.548	−0.004	−0.056	0.107	0.345	−0.282	−0.404
	−0.671	0 782	−0.478	0.210	−0.309	0.418	−0.170	−1 037	−0.648

* estimates based on aggregate data

** estimates based on disaggregated data.

TABLE 5.4 : ESTIMATES OF ITEMWISE NON-COMPENSATED OWN AND CROSS PRICE ELASTICITES CALCULATED AT SAMPLE AVERAGE FOR LES

ALL INDIA—URBAN (7TH-28TH ROUND NSS)

Items	1	2	3	4	5	6	7	8	9
1. Cereals and cereal substitutes	−0.400*	−0.001	−0.013	−0.001	0.007	−0.026	0.016	−0.006	0.016
	−0.392**	0.004	−0.004	−0.001	−0.002	−0.009	0.006	−0.008	0.018
2. Milk and milk products	−0.182	−0.983	−0 033	−0.001	−0.017	−0.066	0.040	−0.015	0.040
	−0.221	−1.111	−0 013	0.003	−0.008	−0 030	0.021	−0.029	0.062
3. Edible oils	−0.083	−0.001	−0.352	−0.000	−0.006	−0.023	0.014	−0.005	0 014
	−0.148	0.011	−0 760	−0.002	−0.005	−0.020	0.014	−0.019	0.042
4. Meat, fish, egg	−0.179	−0.002	−0.032	−0.968	−0.017	−0.005	0.039	−0.015	0.040
	−0.183	0.013	−0.011	−0.938	−0.007	−0.024	0.018	−0 024	0.052
5. Sugar	−0.098	−0.001	−0.018	−0.001	−0.530	−0.036	0.022	−0.008	0.022
	−0.156	0.011	−0.009	−0.002	−0.803	−0 021	0.015	−0.021	0.044
6. Other food	−0.128	−0.002	−0.023	−0.001	−0.012	−0 738	0.028	−0 011	0.028
	−0.171	0.012	−0.010	−0.002	−0.006	−0.896	0.017	−0.023	0.048
7. Clothing	−0.264	−0.004	−0.051	−0.002	−0.027	−0.104	−1.473	−0.024	0.063
	−0.247	0.018	−0.015	−0.003	−0.009	−0.033	−1.237	−0.032	0.070
8. Fuel and light	−0.147	−0.002	−0.026	−0.001	−0.014	−0.053	0.032	−0.804	0.033
	−0.126	0.009	−0.007	−0.002	−0.005	−0.017	0.012	−0.657	0.035
9. Other non food	−0.209	−0.003	−0.038	−0.002	−0.020	−0.076	0.046	−0.018	−1.081
	−0.232	0.017	−0.014	−0.003	−0.009	−0.031	0.022	−0.031	−1.118

* estimates based on aggregate data

** estimates based on disaggregated data.

TABLE 5.5 : ESTIMATES OF ITEMWISE NON-COMPENSATED OWN AND CROSS PRICE ELASTICITIES CALCULATED AT SAMPLE AVERAGE FOR AIDS

ALL INDIA—URBAN (7TH-28TH ROUND NSS)

Items	1	2	3	4	5	6	7	8	9
1. Cereals and cereal substitutes	−0.184*	−0.190	−0.168	−0.074	0.009	0.242	0.298	0.287	−0.569
	0.041**	−0.134	−0.127	−0.115	−0.035	0.140	0.266	0.607	−0.771
2. Milk and milk products	−0.588	−0.468	−0.096	0.443	−0.033	−0.108	−0.558	0.019	−0.417
	−0.443	−1.025	−0.320	0.279	−0.193	−0.204	0.026	−0.217	0.802
3. Edible oils	0.458	−0.470	−0.762	0.163	−0.376	−0.033	0.084	−0.520	1.084
	0.433	−0.556	−0.783	0.168	−0.455	−0.099	0.048	−0.428	1.278
4. Meat, fish, egg	−0.821	0.441	0.410	−0.812	0.342	−0.047	−0.639	1.057	−1.682
	−0.765	0.436	0.222	−0.806	0.133	−0.047	−0.460	0.557	−0.871
5. Sugar	0.680	−0.007	−0.550	−0.100	−0.792	−0.270	0.920	−1.207	2.043
	0.401	−0.163	−0.372	−0.070	−0.737	−0.501	0.817	−1.472	2.455
6. Other food	−0.104	0.544	0.417	0.044	−0.008	−0.902	−0.832	−0.789	1.426
	−0.334	0.367	0.302	−0.020	0.022	−1.070	−0.679	−0.944	1.423
7. Clothing	−0.001	−0.018	0.510	0.100	0.073	−0.625	−1.824	2.573	−4.714
	−1.641	0.366	0.424	0.266	0.741	−0.222	−1.305	2.271	−4.202
8. Fuel and light	−0.030	0.108	−0.040	0.111	−0.090	−0.021	0.014	−0.886	0.104
	−0.013	0.030	−0.073	0.003	−0.016	−0.097	0.006	−0.729	−0.018
9. Other non food	−0.020	−0.544	−0.261	−0.250	−0.221	−0.050	0.587	−0.330	−0.300
	−0.345	−0.101	−0.146	−0.101	−0.000	0.153	0.293	−0.248	−0.844

* estimates based on aggregate data

** estimates based on disaggregated data.

Tables 6.1 and 6.2 present the non-compensated own price elasticities and expenditure elasticities for three percentile groups (poorest 30 per cent, middle 40 per cent and richest 30 per cent) for LES and AIDS calculated at 28th round NSS data for rural and urban India respectively. As one moves from a lower expenditure class to a higher expenditure class, one would normally expect the magnitude of the own price elasticities and expenditure elasticities to decline for all commodities. Regarding price elasticities, looking at Table 6.1 we find that on rural data, the LES shows the expected trend 'for milk and milk products', 'clothing' and 'other non food', and the AIDS shows a similar behaviour for 'cereals and cereal substitutes', 'clothing' and 'fuel and light'. 'Edible oils' shows no trend in AIDS. On urban data (Table 6.2), AIDS shows the expected trend for almost all items except for 'meat, fish and egg' and 'other non food' ('other food' shows no trend), while the LES shows the expected trend only for 'milk and milk products', 'clothing' and 'other non food'. Regarding the expenditure elasticities, while in AIDS in both rural and urban sector all items show the expected trend, in LES all necessary items show an increasing trend, but the luxury items show a declining trend.[12]

The compensated own and cross price elasticities of the AIDS were computed at sample average on the disaggregated rural and urban data (Table not presented here). For 'cereals' and 'clothing' in the rural sector the compensated own price elasticities became positive, implying violation of concavity of the cost function. An inconsistency regarding classification of commodities into mutual complements and substitutes has also been found. In view of the fact that symmetry of the Slutsky matrix is not ensured by AIDS theoretically, this result is not, however, unexpected.

4.3 *Stepwise regressions and the AIDS.* It may be observed in Tables 2.1-2.4 that a large number of estimated γ-parameters have large standard errors. This perhaps indicates a fair amount of multicollinearity in the logarithms of prices used as explanatory variables in the item-specific budget share equations of the AIDS. It may be noted that the AIDS, as proposed, is a flexible system of budget share equations each having a large number of parameters that would provide first order approximation to any true unknown budget share equations underlying a given set of consumption data. However, given that in most time series data the prices tend to be correlated, it is worthwhile to see whether the AIDS is really worth all the parameters

[12]The items have been classified into 'necessary' and 'luxury' items according to the respective income elasticity values based on disaggregated data (Table 5.1).

TABLE 8.1 : ESTIMATES OF NON-COMPENSATED OWN PRICE AND EXPENDITURE ELASTICITIES OF THREE PERCENTILE GROUPS FOR LES AND AIDS, CALCULATED AT 28TH ROUND NSS DATA

ALL INDIA—RURAL

Items	LES						AIDS					
	poorest 30%		middle 40%		richest 30%		poorest 30%		middle 40%		richest 30%	
	own price	expen-diture	own price	expen-diture	own price	expen-diture	own price	expen-diture	own price	expen-diture	own price	expen-diture
1. Cereals and cereal substitutes	−0.374	0.457	−0.503	0.669	−0.687	0.729	−0.318	0.669	−0.197	0.610	0.138	0.446
2. Milk and milk products	−1.387	4.618	−1.106	1.995	−1.035	1.326	−0.102	2.527	−0.506	1.901	−0.706	1.536
3. Edible oils	−0.290	0.860	−0.524	0.906	−0.754	0.951	−0 672	1.005	−0.672	1 005	−0.674	1.005
4. Meat, fish, egg	−0.352	1.066	−0.597	1.041	−0.806	1.020	0.702	1.181	−0.809	1.167	−0.830	1.148
5. Sugar	−0.660	2.077	−0.845	1.493	−0.939	1.104	−0.352	1.454	−0.463	1.376	−0.582	1.293
6. Other food	−0.378	0.927	−0.593	0.952	−0.795	0.976	−1.260	0.935	−1.287	0.923	−1.282	0.920
7. Clothing	−1.392	4.650	−1.107	1.909	−1.035	1 326	−4.181	4.017	0.861	2.407	−0.098	1.682
8. Fuel and light	−0.201	0.531	−0.386	0.640	−0.639	0.783	−0.586	0.070	−0.513	0.611	−0.310	0.450
9. Other non food	−1.101	3.628	−1.033	1.856	−1.011	1 294	−0.046	2.064	−0.496	2.037	−0.718	1.681

TABLE 6.2: ESTIMATES OF NON COMPENSATED OWN PRICE AND EXPENDITURE ELASTICITIES OF THREE PER CENTILE GROUPS FOR LES AND AIDS CALCULATED AT 28TH ROUND NSS DATA

ALL INDIA- URBAN

Items	LES						AIDS					
	poorest 30%		middle 40%		richest 30%		poorest 30%		middle 40%		richest 30%	
	own price	expen-diture	own price	expen-diture	own price	expen-diture	own price	expen-diture	own price	expen-diture	own price	expen-diture
1. Cereals and cereal substitutes	−0.214	0.214	−0.316	0.316	−0 487	0.487	−0 360	0.551	−0.161	0.411	0.634	−0 076
2. Milk and milk products	−1.474	2.520	−1.174	1 657	−1 005	1.210	−1 038	1 602	−1 029	1.457	−1.022	1.338
3. Edible oils	−0 444	0.693	−0.624	0.792	−0.706	0.887	−0.845	0.900	−0.836	0.895	−0.821	0.885
4. Meat, fish, egg	−0.748	1.205	−0.802	1.112	−0 937	1 051	−0.783	1 118	−0.706	1 111	−0 812	1.102
5. Sugar	−0.592	0.047	−0.702	0.968	−0 878	0 984	−0.790	0.010	−0 770	0.906	−0 702	0.898
6. Other food	−0.753	1.142	−0.802	1.079	−0.936	1.037	−1.070	1.040	−1.008	1.048	−1.066	1.046
7. Clothing	−2.232	3.849	−1.338	1.782	−1 117	1.270	−2.258	3.698	−1.519	2.113	−1.279	1.509
8. Fuel and light	−0.392	0.592	−0.607	0.710	−0.753	0 834	−0.774	0 731	−0.737	0 687	−0.653	0.688
9. Other non food	−1.420	2.702	−1.147	1.506	−1 055	1.221	−0.619	2 298	−0.792	1.770	−0.869	1.483

it has. To examine this for the present set of data, the stepwise regression procedure was applied to estimate the individual budget share equations based on the disaggregated set of data for rural and urban India separately. A more meaningful approach would be to estimate the homogeneity and symmetry restricted version of the AIDS and check for the validity of these restrictions. We have estimated the homogeneous version of the AIDS on both the aggregate and disaggregated sets of data. The hypothesis is rejected in no case.[14] Table 7 presents a summary of the stepwise regression results. This table gives the names of explanatory variables that enter the regression equations for item specific budget shares at the first few steps (the 'income' variable is actually the real income $y/\bar{P}$) and the corresponding R^2 and $\bar{R}^2$ values. To facilitate comparison, the $\bar{R}^2$ values corresponding to the homogeneous as also the unrestricted versions of the AIDS have also been presented here. It may be observed that with a smaller number of explanatory variables the $\bar{R}^2$ values corresponding to the homogeneous AIDS and those of the truncated regressions are quite close to (and in some cases even higher than) the ones for the full specification of the AIDS. These results demonstrate how the large number of price parameters contained in the AIDS could virtually turn out to be superfluous in the presence of high correlation amongst the price variables.

4.4. *Serial correlation.* To examine the presence of serial correlation in the residuals of the LES and the AIDS estimated on the basis of aggregate data, itemwise Durbin-Watson (D-W) statistics were calculated for the two systems for both rural and urban India. Table 8.1 presents the values of these Durbin-Watson statistics. However, the formal theory of the D-W statistics does not apply to the LES residuals. From the table, fair amount of serial correlations are observed for all items for the AIDS in both sectors and for all items except for 'meat, fish, and egg' in the rural sector and 'meat, fish and egg' and 'fuel and light' in the urban sector for the LES. As regards the results for the disaggregated data used, the problem of serial correlation is also likely to be present in the estimated residuals of the two systems. To detect this, we calculated the simple first order autocorrelation coefficient between the estimated residuals e_{ijt} and e_{ijt-1}, where e_{ijt} denotes the estimated residual for the i-th item ($i = 1, 2, \ldots 9$), j-th population group ($j = 1, 2, 3$)

[14]The symmetry restricted version of the AIDS could not, however, be estimated because of the non-availability of appropriate computational facilities for the NLFIML estimation of the AIDS with the present number of parameters. An alternative procedure for checking parametric parsimony of the AIDS could be based on the Akaike information criterion (*vide* Sawa 1978).

TABLE 7 : ITEM-WISE R^2 AND $\bar{R}^2$ VALUES FOR THE STEP-WISE REGRESSIONS AND THE CORRESPONDING $\bar{R}^2$ VALUES FOR THE HOMOGENEOUS AND THE UNRESTRICTED AIDS

ALL INDIA : RURAL AND URBAN : DISAGGREGATED DATA

(7TH—28TH ROUND NSS)

Sr. No.	Item-group	all-India Rural					all-India Urban				
		step-wise regression			AIDS $\bar{R}^2$		step-wise regression			AIDS $\bar{R}^2$	
		logarithms of variables included as regressors	R^2	$\bar{R}^2$	homo-geneous	unres-tricted	logarithms of variables included as regressors	R^2	$\bar{R}^2$	homo-geneous	unres-tricted
1.	Cereals and cereal substitutes	income	0.946	0.945	.963	0.963	income, price of milk etc., price of other non-non-food	0.993	0.992	.994	0.994
2.	Milk and milk products	income	0.937	0.936	.945	0.946	income	0.876	0.874	.879	0.880
3.	Edible oils	price of cereals etc., price of edible oils	0.677	0.666	.697	0.707	income, price of milk etc., price of edible oils	0.804	0.704	.787	0.792
4.	Meat, fish, egg	income	0.389	0.379	.476	0.480	income	0.330	0.328	.272	0.286
5.	Sugar	income, price of sugar, price of other food	0.886	0.880	.865	0.868	income, price of sugar, price of other food	0.453	0.424	.378	0.411
6.	Other food	income, price of milk etc.	0.548	0.524	.564	0.565	income, price of edible oils, price of other non-food	0.713	0.692	.716	0.718
7.	Clothing	income, price of cereals etc., price of clothing	0.937	0.933	.931	0.931	income, price of cereals etc.	0.930	0.928	0.930	0.943
8.	Fuel and light	income, price of cereals etc., price of other non food	0.954	0.951	.941	0.949	income, price of cereals	0.968	0.966	.966	0.966
9.	Other non-food	income, price of sugar	0.856	0.851	.844	0.843	income, price of other non-food	0.960	0.959	.954	0.954

TABLE 8.1 : ITEMWISE DURBIN-WATSON STATISTICS FOR THE LES AND THE AIDS

All India—Rural and Urban, aggregate data (7th-28th round NSS)

Item	All India rural		All India urban	
	LES	AIDS	LES	AIDS
1. Cereals and cereal substitutes	0.614	0.494	0.805	0.342
2. Milk and milk products	0.859	1.450	0.073	0.533
3. Edible oils	0.753	0.535	1.169	0.377
4. Meat, fish egg	1.812	0.470	2.043	0.304
5. Sugar	0.461	0.608	0.707	0.310
6. Other food	0.187	0.529	0 106	0.328
7. Clothing	0.655	0.817	0.562	0.308
8. Fuel and light	1.264	0.544	1.566	0.393
9. Other non food	1.248	0.653	0.040	0.359

and t-th time point ($t = 1, 2, \ldots 20$).[15] The estimated correlation coefficients are given in Table 8.2. Presence of positive serial correlation is tested by standard test for linear correlation.[16] Judged by the number of cases of rejection of the null hypothesis of zero serial correlation against the alternative of positive serial correlation, the AIDS turns out to be far superior to the LES for both the rural and the urban sectors. The results for the AIDS suggest that at least for the data relating to the rural sector, serial correlation is not a serious problem.

5. Conclusion

We conclude the paper by first pointing out some of the procedural limitations of this study, and then with an overall assessment of the two models (LES and AIDS) discussed.

The price data we have worked with, are wholesale price indices, where ideally we should have used consumer price data. Moreover, the price indices are assumed to be the same over expenditure class having different levels of real per capita expenditure. The other limitation is that the effects of house-

[15] The rounds are not of equal duration and there are occasional gaps between two consecutive rounds. Hence, strictly speaking, taking $t = 1, 2, \ldots, 20$ for the 20 rounds covered here is an over-simplification.

[16] There are obvious objections against such a procedure, and therefore we used it only for rough guidance. It may also be mentioned that because of the nature of the data, standard procedure of calculating equation-specific Durbin-Watson statistics could not be used in this case;

TABLE 8.2: ESTIMATES OF FIRST ORDER SERIAL CORRELATION COEFFICIENTS OF RESIDUALS FOR THE LES AND THE AIDS FOR THREE POPULATION GROUPS

ALL INDIA—RURAL AND URBAN, DISAGGREGATED DATA (7TH–28TH ROUND NSS)

Items	All India rural						All India urban					
	LES			AIDS			LES			AIDS		
	poorest 30%	middle 40%	richest 30%	poorest 30%	middle 40%	richest 30%	poorest 30%	middle 40%	richest 30%	poorest 30%	middle 40%	richest 30%
1. Cereals and cereal substitutes	0.759*	0.474*	0.612*	0.544*	0.139	0.287	0.718*	0.403*	0.517*	0.322	−0.188	0.138
2. Milk and milk products	0.593*	0.257	0.613*	0.078	−0.342	0.353	0.357	0.283	0.342	0.405*	−0.240	0.289
3. Edible oils	0.575*	0.586*	0.732*	0.577*	0.034	0.195	0.496*	0.810*	0.794*	0.130	0.103	−0.410
4. Meat, fish, egg	0.237	0.134	0.094	−0.015	−0.099	−0.119	0.183	−0.373	−0.031	0.131	−0.256	−0.291
5. Sugar	0.658*	0.212	0.439*	0.041	0.039	0.137	0.871*	0.763*	0.221	0.662*	0.084	0.793*
6. Other food	0.487*	0.589*	0.833*	0.125	0.131	0.061	0.892*	0.900*	0.899*	0.880*	0.447*	0.654*
7. Clothing	0.917*	0.855*	0.631*	0.121	−0.179	−0.010	0.876*	0.774*	0.421*	0.139	0.083	−0.180
8. Fuel and light	0.804*	0.742*	0.286	0.389	0.241	0.012	0.278	0.774*	0.200	0.324	0.540*	0.237
9. Other non food	0.207*	0.343	0.593*	0.351	0.452*	0.495*	0.516*	0.248	0.637*	0.556*	0.057	0.343

* significant at 5 per cent level exceeding critical value 0.289

hold size and composition have altogether been ignored in spite of the fact that a change in these factors does change the preference pattern of a household and thus leads to a different consumption pattern even when the prices and household income do not change.

Coming to an assessment of the two models, based on the results obtained in the present analysis, we may conclude that AIDS performed better than LES on the whole. On the basis of the theoretical backgrounds of the two models, this result was, however, expected. First of all because of the large number of parameters, AIDS has a greater explanatory power ; and secondly, the elasticities of AIDS are not restricted as in LES. We may mention here that the constant of proportionality between the income and non compensated own price elasticity in LES has been found to be approximately -1.2 for both aggregate and disaggregated urban data, approximately -1.8 for rural aggregate data, and approximately -1.4 for rural disaggregated data.

At the end, few comments may be worthwhile. For a finer level of disaggregation of commodities, both the LES and AIDS might turn out to be unsatisfactory. While AIDS will have too many parameters to estimate, LES will give very restrictive results in terms of elasticity estimates. In this situation some other model would probably be more suitable.

Acknowledgement

The author wishes to thank Dr. Dipankor Coondoo for his guidance in preparing this paper. Thanks are also due to Professor N. Bhattacharya and an anonymous referee of this Journal for his valuable suggestions which substantially improved the paper.

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Paper received : October 1983.

Revised : February, 1985.