Jour. Ind. Soc. Ag. Statistics
Vol. XXXVIII, No. 2 (1986), pp. 173-179

THE EFFECT OF HOUSEHOLD COMPOSITION ON CONSUMPTION PATTERN OF MILK AND MILK PRODUCTS

BHUPAL SINGH, P. KUMAR and R. K. PATEL
National Dairy Research Institute, Karnal-132001

(Received : September, 1983)

SUMMARY

A method for estimating the adult consumer scales which is a modification of the Singh-Nagar iterative procedure has been discussed. Empirical results indicate the effect of household composition on consumption pattern for milk. Considerable influence was exerted by household composition on the consumption disposition of milk and milk products. Expressing the household structure on per capita basis, the consumption and income elasticity estimate have lower values than when they are related to per adult unit basis.

Keywords : Engel curve analysis; Elasticities; Least Square Method; consumption pattern.

Introduction

The consumption pattern of commodities in a household is influenced by economic and non-economic factors. The individual members of a family do not have identical pattern of consumption. The occupations of household members, as well as their age-sex distribution and marital status might be significant determinants of the consumption pattern in addition to income, taste, size of households, etc. The traditional Engel curve analysis relates the per capita demand for a particular commodity only to per capita income of the household members leading to specification errors in the estimation of income elasticities. Therefore, it is necessary to incorporate household composition as a determinant in the analysis of consumption pattern. This requires estimation of 'item-specific' and 'income equivalent' standard consumer scales for converting household members by age and sex to standard consuming units (such

as adult males). The Engel curve analysis can then be carried out in terms of per unit rather than per capita expenditures. Results obtained from such analysis give more accurate commodity demand projections.

A modification to the Singh-Nagar ([4], [5]) iterative procedure has been suggested for estimating the equivalent adult consumer scales and also the effect of household age–sex composition on consumption pattern for milk and milk products examined. Results are based on the family budget data for the year 1976-77, collected by interviewing a cross-section of 220 households (160 rural and 60 urban) in Muzaffarnagar district of Uttar Pradesh.

Methodology

Determination of Consumer Scales

Several procedures for estimating the specific and income consumer unit scales have been developed. The more recent one, the Singh-Nagar [4] iterative procedure, which is essentially a modification of the Prais and Hauthakker [2] method, has the advantage that it enables the use of several functional forms of Engel curve without arbitrarily fixing value of any parameter. Muellbauer [1] pointed out that the Singh-Nagar approach, like that of Prais-Houthakker's suffers from a crucial identification problem and suggested that if equivalent adult scales could be specified a priorily for at least one commodity, then consumer scales for all other commodities could be identified. Therefore, the problem is to determine the specific scales for each age-sex group for at least one item. Singh and Nagar [5] argued that one could easily estimate the specific scales for a commodity having zero or nearly zero income elasticity of demand. In real world, however, it is difficult to find a commodity with zero income elasticity of demand (1); (3) and therefore, the Singh-Nagar (5) modified procedure will also not be of much use for determination of accurate consumer scales. In this paper a simple alternative is suggested which involves data collection at the survey stage, on consumption of at least one item (like milk) for individual members of the sample households.

Let C_{igj} ($i=1,\ldots I^*$, $g=1\ldots, G$, $j=1,\ldots, N$) be the consumption of ith item in gth age-sex group and jth household, let n_{gj} be the number of persons in gth age-sex group and jth household, 'I^*' be the number of items on which data on consumption were collected for individual members of the sample households, G be the number of age-sex groups, and N be the number of sample households. One can derive the estimate of equivalent adult male scale (W_{ig}) for 'ith' item and 'gth' age-sex

group as

$$\tilde{W}_{ig} = \frac{\hat{R}_{ig}}{\hat{R}_{i1}} \qquad g = 1, 2, \ldots, G \text{ and} \qquad (1)$$

$g = 1$ for adult male

$i = 1, \ldots, I^*$

Where, $\hat{R}_{ig} = \sum_{i=1}^{N} C_{igj} / \sum_{j=1}^{N} n_{gj}$ is the estimate of per capita consumption of ith item and in gth age sex-group.

Estimate the equivalent-adult male scales (W_{ig}, $g = 1 \ldots, G$) from (1) for I^* items and use these values as prior information in estimating W_{ig} ($i = I^* + 1, \ldots, I$; $g = 1, \ldots, G$) under the constraint $0 \leqslant W_{ig} \leqslant 2$ for other items by employing the Singh-Nagar iterative procedure. This will solve the problem of identification as mentioned by Singh-Nagar [5] and estimate both specific and income scales. The procedure of estimating W_{ig} and W_{og} may now be outlined as follows :

Let the Engel function in per unit terms for ith item be specified as

$$C_{ij} / \sum_{g} \tilde{W}_{ig}\, n_{gj} = f_i \left(Y_j / \sum_{g} \tilde{W}_{og}\, n_{gj}\right) \qquad (2)$$

where, for household j, c_{ij} is expenditure on ith item, Y_j is income (or total expenditure), $\tilde{W}_{ij}$ and $\tilde{W}_{og}$ are the value of equivalent adult male for gth age-sex group measured on the specific (ith item) and income scales, respectively.

Once the estimates of W_{ig}'s are known for all 'i', then the corresponding estimates of W_{og}'s worked out as

$$\tilde{W}_{og} = \sum_{i=1}^{1} \lambda_i \;\; \tilde{W}_{ig} : \lambda_i = \frac{1}{N} \sum_{j=1}^{N} \frac{C_{ij} / \sum_{g} \tilde{W}_{ig} \cdot n_{gj}}{Y_j / \sum_{g} \hat{W}_{og}} \qquad (3)$$

Use $\tilde{W}_{ig}$ ($g = 1, \ldots, G$) for I^* items as estimated from (1) and set initially $\tilde{W}_{ig}$ ($i = I^* + 1, \ldots, I$; $g = 1, \ldots, G$) and $\hat{W}_{og}$ ($g = 1, 2, \ldots, G$) equal to unity in (3) and fit several alternative forms of the Engel function (1) by least squares method and select the one which explains the maximum variation in the dependent variable. Compute $\hat{f}_i (Y_j / \sum_{g} \tilde{W}_{og}\, n_g)$ from the selected form of the Engel function for each item of consumption and regress $C_{ij} / f_i \left(Y_j / \sum_{g} \tilde{W}_{og}\, n_g\right)$ on $n_{1j}, \ldots, n_{Gj}$ i.e.

$$C_{ij} / f_i \left(Y_j / \sum_{g} \tilde{W}_{og}\, n_g\right) = \tilde{\tilde{W}}_{i1}\, n_{1j} + \ldots, + \tilde{\tilde{W}}_{iG}\, n_{Gj} \qquad (4)$$

set $\tilde{\tilde{W}}_{i1} = 1$ for adult male and transform (4) as

$$C_{ij} / \hat{f}_i \left(Y_i / \sum_g \tilde{W}_{og}\, n_{gj} \right) - n_{1j} = \tilde{\tilde{W}}_{i2}\, n_{2j} + \ldots + \tilde{\tilde{W}}_{iG}\, n_{Gj} \qquad (5)$$

$$i = I^* + 1, \ldots, I$$

This formulation has the advantage that it gives the equivalent-adult male scales directly. Estimate $\tilde{\tilde{W}}_{i2}, \ldots, \tilde{\tilde{W}}_{iG}$ that is equivalent-adult male scales for 'g' age-sex groups, respectively for ith consumer item under the constraint $0 \leqslant \tilde{\tilde{W}}_{ig} \leqslant 2$, $g = 1, \ldots, G$ using Theil-Goldberger [6] mixed estimation procedure. These constraints will reduce the possibility of obtaining negative consumer scales from (5) and also save $\tilde{\tilde{W}}_{ig}$ from unexpectedly large or small magnitudes.

Using $\tilde{W}_{ig}$ $(i = 1, \ldots, I^*)$ from (1), $\tilde{\tilde{W}}_{ig}$ $(i = I^* + 1, \ldots, I)$ from (5) for all $g = 1, \ldots, G$ in the following expression (6) we get the estimate of equivalent-adult male (W_{og}) for income (or total expenditure).

$$\tilde{\tilde{W}}_{og} = \sum_{i=1}^{I^*} \lambda_i^1\, \tilde{W}_{ig} + \sum_{i=I^*+1}^{I} \lambda_i^2\, \tilde{\tilde{W}}_{ig} \qquad (6)$$

where,

$$\lambda_i^1 = \frac{1}{N} \sum_{j=1}^{N} \frac{C_{ij} / \sum_g \tilde{W}_{ig}\, n_{gj}}{Y_j / \sum_g \tilde{W}_{og}\, n_{gj}}, \; i = 1, \ldots, I^*,$$

$$\lambda_i^2 = \frac{1}{N} \sum_{j=1}^{N} \frac{C_{ij} / \sum_g \tilde{\tilde{W}}_{ig}\, n_{gj}}{Y_j / \sum_g \tilde{W}_{og}\, n_{gj}} \quad i = I^* + 1, \ldots, 1$$

Replace $\hat{W}_{og}$, $\tilde{W}_{og}$, $\tilde{W}_{ig}$ by $\tilde{W}_{og}$, $\tilde{\tilde{W}}_{og}$ and $\tilde{\tilde{W}}_{ig}$ respectively for $g = 1, \ldots, G$ and $i = 1, \ldots, I$ between (2) and (5) and obtain the fresh estimates of W_{ig} and W_{og}. Continue the process untill the difference between the estimates of W_{ig} and W_{og} in two consecutive iterations becomes less than 0.0001.

Empirical Results

Data on consumption of milk items for individual members of the sample households were recorded at the field level and used for estimating the consumer unit scales. Household members, were classified into four age-sex groups i.e. adult male, adult female, adolescents (5-14 years of

age) and children (below 5 yrs. of age). The consumer items were divided into five groups (liquid milk, ghee and butter, other milk products, other food items and non-food items). Ten alternative specifications of the Engel curve† were estimated by ordinary least squares method and the most plausible form which explained maximum variation in dependent variable was used in the analysis for determination of consumer unit scales for other food and non-food items, and income elasticity of demand. The iterative procedure converged rapidly, only in 3 iterations for both sectors.

For the milk items* and total expenditure** (income) the equivalent-adult scales for rural and urban sectors are presented in Table-1. The results indicate that magnitudes of equivalent-adult scales for different milk items and income vary for different age-sex, groups. The scales rightly vary for any specific milk item in the two sectors and for different milk items within the same sector. Adult males accounted for the consumption of dairy products with greater consumption of ghee and butter as compared to liquid milk and other milk products. This may be because adult male members are involved in relatively more strenuous physical work and get priority over other household members for allegedly conventional and economic reasons. Singh-Nagar [4] arrived at more or less similar conclusions concerning consumption of 'food' items while investigating the effect of household composition on consumption pattern in rural areas of Western Uttar Pradesh. Urban children below 5 years were receiving proportionately higher level of liquid milk as compared to rural children.

The numerical value of total expenditure scales was highest for adult males followed by adolescents and adult females and minimum for children. The school going children were getting priority in total expenditure over the adult female in both sectors. This may be due to the high cost of education for this age-group. As the adult females in the rural areas have limited expenditure, the relative weights for them were lower than their counterparts in the urban areas.

Consumption and Expenditure Elasticity

The consumption and expenditure elasticities of milk items on the basis of per capita and per adult male unit are given in Table 2.

†The 10 algebraic forms of Engel function namely Linear, Parabolic, Hyperbolic, Semi logarirhmic, Semi-log-inverse, double-log, Log-inverse, Log-log inverse, Exponential, and Log-parabolic were used in the present study.

*Based on the availability of fat content in milk of different species of milch animals and various milk products, the milk and milk products consumed by households were converted into standard fluid milk of 4.5 per cent fat.

**Total consumer expenditure is treated as a proxy of income of the household.

TABLE 1—EQUIVALENT ADULT MALE SCALES FOR MILK, MILK PRODUCTS AND TOTAL EXPENDITURE (1976-77)

Items	*Age-Sex-Group*			
	Children	*Adolescents*	*Adult female*	*Adult male*
		Rural		
Liquid Milk	0.689	0.708	0.749	1.000
Ghee and Butter	0.239	0.578	0.667	1.000
Other Milk products	0.377	0.622	0.766	1.000
Total Milk	0.494	0.642	0.719	1.000
Total Expd. (Income)	0.820	0.924	0.890	1.000
		Urban		
Liquid milk	0.774	0.679	0.730	1.000
Ghee and Butter	0.343	0.507	0.668	1.000
Other milk products	0.525	0.568	0.698	1.000
Total Milk	0.579	0.599	0.703	1.000
Total Expenditure (income)	0.689	0.986	0.943	1.000

TABLE 2—CONSUMPTION PATTERN AND EXPENDITURE ELASTICITIES FOR MILK AND MILK PRODUCTS (1976-77)

Items	*Rural*		*Urban*	
	Per Capita	*Per Unit*	*Per Capita*	*Per Unit*
	Monthly Consumption Pattern in Kgs.			
Liquid Milk	12.59	15.40	11.04	13.60
Ghee and Butter	0.46	0.64	0.33	0.48
Other Milk Products	4.03	5.31	3.59	4.84
Total	25.59	33.55	21.52	28.48
	Expenditure Elasticities			
Liquid Milk	0.851	0.792	0.693	0.696
Ghee and Butter	1.333	1.726	1.190	0.905
Other Milk Products	1.086	1.280	0.571	2.016
Total	0.857	0.940	0.948	1.005

The average consumption per adult male unit of different milk items was more than the corresponding average per capita consumption. The per capita figures under-state the true consumption level. This tendency was relatively more pronounced in the rural areas as compared to that in the urban sector. Higher consumption of milk and milk products in rural sector can be attributed to the fact that more of the consumers are producing milk for their home consumption. Further, relatively high price of milk in urban sector has restricted the consumption of milk in urban sector. The introduction of household composition in the Engel curve has generally increased the magnitude of expenditure elasticities to some extent. Liquid milk is identified as a necessary item whereas milk-products were the luxury items in both sectors.

ACKNOWLEDGEMENTS

The authors are grateful to the referees for their valuable suggestions in improving the manuscript of the paper.

REFERENCES

[1] Muellbauer, J. (1975) : Identification and Consumer unit scales, *Econometrica*, **43** (4) : 807-809.

[2] Prais, S. J. and Houthakker, H. S. (1975) : *The Analysis of Family Budgets*, The University Press, Cambridge.

[3] Singh, Balvir (1972) : On the determination of Economics of scale in household consumption, *International Economic Review*, **13** (2) : 257-270.

[4] Singh, Balvir and Nagar, A. L. (1973) : Determination of Consumer Unit Scales, *Econometrica*, **41** (2) : 347-56.

[5] Singh, Balvir and Nagar, A. L. (1978) : Identification and Estimation of Consumer Unit Scales, *Econometrica*, **46** (1) : 231-33.

[6] Theil, H. and Goldberger, A. S. (1961) : On Pure and Mixed Statistical Estimation in Economics, *International Economic Review*, **2** (1) : 65-78.