Testing The Validity Of Engel's Law For Indian Household Consumption Expenditure Data

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Abstract:

Background*: The relationship between expenditure on food and total expenditure has been a matter of interest for a very long period of time, dating back to German statistician Ernst Engel, who was the first to show that a household's expenditure on food and other items depended on its income or total expenditure. Various studies across the world have attempted to fit different functional forms of the Engel curve ranging from linear, semi logarithmic, double logarithmic, Working-Leser etc. Studies have also shown that household size needs to be included in fitting the functional form of the Engel curve along with total expenditure. This paper is an attempt along similar lines in the Indian context.*

Materials and Methods*: The data used for analysis has been extracted from Household Consumer Expenditure: NSS 68th Round microdata, using SPSS. Monthly per capita expenditure, which is used as a proxy for income, has been divided into 12 MPCE classes. A linear regression model having household food expenditure as the dependent variable and total expenditure and household size as predictors has been used to check the validity of Engel's law in the Indian context.*

Results: *Co-efficients for total expenditure are found to be highly significant for both rural and urban India, and they decline in general as MPCE class progresses from the lowest to the highest, thus indicating that the data for India conform to Engel's law. The spikes observed at a few MPCE classes may be attributed to households opting for better quality goods with an increase in income. Co-efficients of household size are positive indicting that specific effect dominates the income effect.*

Conclusion: *The linear functional form provides a very good fit for both rural as well as urban India. The co-efficients for total expenditure for both the sectors declines as we move along the MPCE classes, i.e. proportion of household expenditure on food decreases as income (total expenditure) increases, which indicates total conformity with Engel's law. Also, the co-efficients for household size are all positive, indicating that for India, the "specific effect" dominates the "income effect".*

Key Word*: Engel's law, Household consumer expenditure survey 2011-12 India, Hosehold expenditure, Food expenditure*

I. Introduction

Household consumer expenditure refers to the expenditure incurred by a household on domestic consumption during the relevant reference period. It is the total monetary value of consumption of various groups of items, i.e. food, fuel, light, clothing, footwear, miscellaneous goods and services, and durable articles. Indians are now spending much more on high-value foods, and consumption is shifting from plant-based to animal-based protein, thanks to increasing disposable incomes and evolving consumer needs. And while agricultural productivity grew over the last decade, there has been a qualitative shift from basic food grain to high value agriculture, especially fruits and vegetables (Confederation of Indian Industry and McKinsey, 2013).

The latest National Sample Survey Office (NSSO) report released in 2013, India's official source of consumption, employment and other statistics, provides more insight into India's consumption habits as of 2011-2012. The report says the top 5 per cent of urban India spends Rs 3,000 per capita per month on groceries and eating out on average. This class consumes the least amount of cereals, save for derivative cereals such as noodles and bread, while their consumption of milk, eggs, meat and other processed foods rises. At the other end of the spectrum, the bottom 5 per cent of India spends just over Rs 400 per person per month on food and a quarter of this is on cereals. Again, rural India's average Monthly per Capita Expenditure (MPCE) rose to INR 1,278.94 in 2012, while that of urban India stood at INR 2,399.24, depicting a rural-urban divergence of approximately 87.6%.

Notwithstanding this, MPCE grew slightly faster in rural India, by 37.86% since 2010, compared to the 34.35% increase in urban India.

Moreover, while food expenses, on average, accounted for nearly half of the total expenditure of rural Indians, at 48.63% of MPCE in 2012, the corresponding figure for the urban population was roughly 10% lower, at only 38.47%. Despite rural Indians spending a higher percentage of their MPCE on food, this has been on the decline across rural and urban India. Also noteworthy are the substantial inter-state disparities in consumption expenditure. In 2012, Lakshadweep had the highest MPCE among rural India, at INR 2,926.03, followed by Kerala and Goa, which stood at INR 2,509.92 and INR 2,458.24 respectively. Meanwhile, MPCE was just INR 880.24 in the rural sector of Orissa, around three times lower than Lakshadweep. On the other hand, within the urban sector, Andaman and Nicobar Islands enjoyed the highest MPCE at INR 4,547.27, followed by Chandigarh at INR 3,351.52 and Haryana at INR 3,253.29. The lowest MPCE was recorded in the urban sector of Manipur at INR 1,393.53.

The relationship between expenditure on food and total expenditure has been a matter of interest for a very long period of time, dating back to German statistician Ernst Engel, who was the first to show that a household's expenditure on food and other items depended on its income or total expenditure (Houthakker, 1987). The basic relation is written as

$$x_i = f_i(y, z)$$

where x_i represents the household's expenditure on the ith commodity , y is some indicator of the household's overall resources, and z represents the vector of other variables influencing x_i.

Various functional forms of the Engel curve have been used for fitting expenditure data like linear, semi-logarithmic, double logarithmic, Working-Leser, etc, Allen and Bowley (1935) assumed a linear mathematical form of the Engel curve and applied it on data sets from a range of countries. Prais and Houthakker (1971) have emphasised the inclusion of household size in the Engel curve specification. Deaton and Paxon (1998) show that holding per capita total household expenditure constant, per capita expenditure on food falls with the number of heads. Accordingly, in this paper, an attempt is made to check whether data from Indian households conform to Engel's law using a linear regression model with total expenditure and household size as explanatory variables.

II.   REVIEW OF LITERATURE

In the study 'The Patterns of Consumption Expenditure in Rural Households of Western Odisha of India: An Engel Ratio Analysis' by Hemanta Kumar Pradhan and Narayan Sethi, it was observed that the average MPCE of ST/SC's is lower than that of general households, also lower than the Muslim class. MPCE on both food and non-food was higher for general households. Tribal class belonging to top expenditure class spend more on food items like cereals, fish and egg, chicken and non-food items like pan, tobacco and intoxicants. These groups spend less on food items like Milk and milk products, pulses, fruits, refreshments and non-food items like footwear, education, clothing etc.

Satyaki Roy, in his paper 'Trends and Patterns in Consumption Expenditure: A Review of Class and Rural-Urban Disparities', observes that in contrast to what is generally held that differences in consumption of necessaries across classes decline more the economy grows, this paper argues that there had been hardly any sign of convergence. In their study, 'Trends and Pattern of Consumption of Value Added Foods in India', Michel Morisset and Pramod Kumar studied the food consumption pattern by expenditure groups for urban and rural India and across states for urban India; classified the food items in accordance with the level of processing and to analyse the trend and pattern of consumption of processed food; and analysed the consumption of the highest income group of urban households as symptomatic of future consumption pattern. They concluded that the economic growth over the study period did result in distribution of wealth among the households but the resulted increase in expenditures went on non-food items and mostly on "education, medical care, rent and taxes" and "fuel and light".

Nadeem A. Burney and Ashfaque H. Khan (1992), in their study examined household consumption patterns in Pakistan by estimating various functional forms of Engel curve and included household size also as an explanatory variable in their analysis. In the present study on India, household size is included as an explanatory variable alongside total expenditure for analysis purposes, with household expenditure on food representing the dependent variable.

III. Material And Methods

The data used for analysis has been extracted from Household Consumer Expenditure: NSS 68th Round microdata, using SPSS. The NSS surveys on Household Consumer Expenditure involve a large sample of households and were conducted quinquennially, with the 68th round being the 9th survey in the series. The survey involved 101662 households, of which 59695 belonged to rural India, while the rest 41967 belonged to urban India. The survey was conducted between July, 2011 to June, 1012. Survey on household consumption

expenditure provides the first and foremost indicator of standard of living, namely monthly per capita consumption expenditure (MPCE). It also brings to light inter-state and rural urban variation in consumption of various items.

The 10662 households have been divided into 12 classes of MPCE in keeping with the limits used in the Key Indicators of Household Consumer Expenditure in India published in June, 2013. These classes, which are detailed in Table 1 below, are computed separately for rural and urban India to account for the income/ expenditure differentials in both the sectors. Since income data is difficult to obtain in an accurate manner, most studies us expenditure as a proxy for income, and the same procedure is followed in our analysis.

Table 1: Sector-wise range of MPCE class

MPCE Class	Rural MPCE (in Rs.)	Urban MPCE (in Rs.)
1	≤ 525	≤ 725
2	525- 600	725- 860
3	600- 720	860- 1090
4	720- 825	1090- 1295
5	825- 925	1295- 1510
6	925- 1035	1510- 1760
7	1035- 1165	1760- 2070
8	1165- 1335	2070- 2460
9	1335- 1585	2460- 3070
10	1585- 2055	3070- 4280
11	2055- 2625	4280- 6015
12	>2625	>6015

Source: NSSO report on Key Indicators of Household Consumer Expenditure in India, 2013

Statistical analysis: In this paper, for both rural and urban India, we attempt to fit a model of the form

$$FE_i = \alpha + \beta_1 TE_i + \beta_2 HHS_i + \epsilon_{ij}$$

Where FE_i = Food expenditure for the ith household
TE_i = Total expenditure of the ith household
HHS_i = Household size of the ith household

Linear regression model with total expenditure and household size as the predictors and food expenditure as the regressand will be fitted separately for rural and urban India with the help of SPSS. This is done to account for the possible differentials in the levels of income (expenditure) across the two sectors. The goodness of it of the model would be assessed using the R-squared values. Statistical significance of the partial regression co-efficients would be tested comparing the p-values with the level of significance. The model would be fitted for each of the MPCE classes, and the corresponding goodness of fit along with the significance of the partial regression co-efficients would be reported.

IV. Results & Discussion

We first attempt to observe the share of food expenditure of households as a proportion of total expenditure for both rural and urban India across the 12 MPCE classes.

Table 2: Sector and MPCE class -wise share of food expenditure of households as a proportion of total expenditure

MPCE class	Share of expenditure on food (%)	
	Rural	Urban
1	60.02	57.88
2	59.26	56.16
3	59.04	54.4
4	58.23	52.35
5	57.60	50.51
6	56.50	48.27
7	55.59	46.32
8	53.90	44.13
9	52.22	41.46
10	48.87	37.18
11	44.91	32.84

12	34.49	23.75

From the above table, we observe that for both rural India and urban India, the share of expenditure on food declines with the increase in income. Hence the proportion of total expenditure on food is the highest, around 69% for the lowest income class in rural India and 58% for urban India, and the lowest share is approximately 35 % and 23% in the highest income class in rural and urban India respectively.

Table 3: Sector and MPCE class-wise values of R2

MPCE class	Rural	Urban
1	0.895	0.900
2	0.884	0.877
3	0.873	0.871
4	0.881	0.855
5	0.877	0.841
6	0.865	0.821
7	0.860	0.800
8	0.854	0.795
9	0.834	0.796
10	0.804	0.740
11	0.744	0.691
12	0.456	0.392

Source: Author's calculation from unit level NSSO data 2011-12

From the above table, we observe that the co-efficient of determination for rural India ranges from 46% to 90% across the MPCE classes, while that for urban India ranges from 39% to 90%. This indicates that linear regression model provides a very good fit for the higher MPCE classes in comparison with the lower MPCE classes.

Table 4: Regression results

MPCE class	Predictors	Rural			Urban		
		Unstandardised co-efficients	Standard error	p-value	Unstandardised co-efficients	Standard error	p-value
1	Constant	-53.398	18.604	0.004	-41.256	21.307	0.053
	Total expenditure	0.604	0.018	0.000**	0.559	0.016	0.000**
	Household size	7.454	8.596	0.386	19.419	10.407	0.062
2	Constant	-81.571	23.547	0.001	-81.876	24.357	0.001
	Total expenditure	0.607	0.068	0.000**	0.484	0.042	0.000**
	Household size	5.930	38.633	0.878	76.099	33.236	0.022*
3	Constant	-21.225	17.024	0.213	-46.133	19.830	0.020*
	Total expenditure	0.519	0.031	0.000**	0.433	0.021	0.000**
	Household size	51.040	20.832	0.014*	117.049	20.928	0.000**
4	Constant	-8.929	16.254	0.583	16.699	24.056	0.488
	Total expenditure	0.469	0.035	0.000**	0.460	0.029	0.000**
	Household size	88.943	27.304	0.001**	71.843	34.427	0.037*
5	Constant	-7.551	16.926	0.656	46.902	27.935	0.093
	Total expenditure	0.512	0.039	0.000**	0.359	0.034	0.000**
	Household size	57.547	34.276	0.093	195.345	48.054	0.000**
6	Constant	54.688	17.859	0.002	108.256	30.298	0.000
	Total expenditure	0.444	0.039	0.000**	0.435	0.034	0.000**
	Household size	107.747	38.140	0.005**	54.521	56.340	0.333
7	Constant	57.620	18.164	0.002	102.989	32.945	0.002

	Total expenditure	0.497	0.035	0.000**	0.356	0.032	0.000**
	Household size	53.719	38.291	0.161	181.574	60.122	0.003**
8	Constant	115.294	18.084	0.000	274.857	33.494	0.000
	Total expenditure	0.382	0.028	0.000**	0.394	0.028	0.000**
	Household size	172.134	35.147	0.000**	38.764	64.020	0.545
9	Constant	148.328	19.139	0.000	213.884	33.716	0.000
	Total expenditure	0.432	0.021	0.000**	0.291	0.020	0.000**
	Household size	99.569	31.320	0.001**	282.436	56.331	0.000**
10	Constant	246.397	20.522	0.000	650.112	34.739	0.000
	Total expenditure	0.316	0.013	0.000**	0.228	0.012	0.000**
	Household size	253.032	24.232	0.000**	327.226	43.775	0.000**
11	Constant	430.208	33.686	0.000	818.330	57.122	0.000
	Total expenditure	0.251	0.019	0.000**	0.174	0.016	0.000**
	Household size	353.118	44.139	0.000**	503.898	77.970	0.000**
12	Constant	573.306	91.012	0.000	655.127	193.482	0.001
	Total expenditure	0.197	0.004	0.000**	0.164	0.006	0.000**
	Household size	455.433	25.675	0.000**	451.858	78.880	0.000**

Source: Author's calculation from unit level NSSO data 2011-12
**indicates significance at 1% probability level
*indicates significance at 5% probability level

The above table indicates that the data for India are in conformity with Engel's law, since as income increases from the first MPCE class till the twelfth, which consists of the richest 5% of the Indians, the amount by which food expenditure increases with unit increase in total expenditure generally declines, except at a very few MPCE classes in between. The co-efficients for total expenditure are all highly significant at 1% level of significance.

The table for Rural India shows that the partial regression co-efficients for total expenditure gradually decline across each subsequent MPCE class, except for a small spike in the 2nd, 5th, 7th and 9th MPCE class. As far as urban India is concerned, the partial regression co-efficients for total expenditure also post a decline across each subsequent MPCE class, with it showing a slight increase in the 4th, 6th and 8th MPCE class. These spikes may be attributed to the fact that with an increase in income, households opt for better quality food products. For rural areas, this propensity towards better quality food products appears consistently as one moves to higher income groups, while that for urban areas occur more systematically in the middle income groups (MPCE class).

As far as the co-efficients of household size are concerned, for rural India, it is found to be not significant for the 1st, 2nd ,5th and 7th income class. For urban India, the co-efficient of household size is not significant for MPCE class 1, 2, 4, 6 and 8. According to Houthakker (1957), a combination of "specific effect" and "income effect" is reflected in the co-efficient of household size. "Specific effect" is a consequence of increase in need for commodities as household size increases, whereas income effect is the effect where a household becomes poorer due to an increase in household size. The increase in need referred to in the specific effect is less than proportional to the increase in household size. If the income effect is dominated by the specific effect, the co-efficient for household size is positive, otherwise it is negative. In the present study, the co-efficients for household size are positive for households in all MPCE classes, indicating that for food, "specific effect" dominates the "income effect".

V. Conclusion

The fitting of a linear model with total expenditure and household size as predictors and household food expenditure as the regressand for Indian household consumption expenditure data, 2011-12 provides a very good fit for both rural as well as urban India. The co-efficients for total expenditure for bothe the sectors declines as we move along the MPCE classes, i.e. proportion of household expenditure on food decreases as income (total expenditure) increases, which indicates total conformity with Engel's law. Also, the co-efficients for household size are all positive, indicating that for India, the "specific effect" dominates the "income effect".

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