

Estimation Of Commodity Group Expenditure Elasticities For The Indian Economy

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ABSTRACT

Elasticity is a number that tells us the percentage change that occurs in one variable in response to a one per cent increase in another variable, and hence, we need some accurate method of comparing elasticities of consumption expenditure for different commodity groups. An attempt is made in the present study to estimate the expenditure elasticities of commodity groups comprising of durables, non-durables and services in the Indian economy during the period from 1950-51 to 2007-08 with two sub-periods, viz. 1950-51 to 1989-90 (pre-reform period) and 1990-91 to 2007-08 (post-reform period) at 1999-00 prices. The expenditure elasticity estimated during the period of the study reveals that the demand for non-durables, primarily consisting of food commodity groups was found to be less than unity confirmed the well-known Engel's law. Very high elasticities of expenditure, with more than unity found in commodity groups consisting of durables and services have turned out to be luxuries or ultra-superior commodities. The proportion of expenditure incurred on these goods has increased as total expenditure increased and aligned with Engel's law.

Keywords : Elasticity, Elasticities, Elasticity of demand, Expenditure elasticity, Expenditure, Food consumption

JEL Classification : D1, D100, D110, D121

INTRODUCTION

The pattern of consumption expenditure on commodity groups over a period of time gives a broad idea of the change in household consumption levels and style. It is due to the increase in earnings the consumption pattern of the people changes over a period of time. The study of consumption behavior is certainly a useful one in devising a plan for faster economic development as estimates of consumer expenditure elasticities are helpful in taking a variety of key decisions. For instance, allocation of developmental resources to various sectors according to their respective demands, readdressing the tax policy, demand forecasting, etc. all belong to the nature of elasticity of durable and non-durable commodities. Thus, the consumption pattern determines the private domestic savings, which form a substantial part of capital formation. Not only that, even the estimation of expenditure elasticities for different commodity groups enables us to examine the responsiveness of consumption expenditure on the i^{th} commodity group to the changes in total expenditure of households over a period of the study. With this backdrop, through the present study, an attempt is made to estimate expenditure elasticities of commodity groups in India during the period from 1950-51 to 2007-08 at the 1999-2000 prices as the standard and constant one. The sign and magnitude of expenditure elasticities enable us to classify commodity groups into luxury, necessary and inferior groups.

LITERATURE REVIEW

There are a plethora of studies on consumption pattern with reference to expenditure elasticities for commodity groups. Some of them are reviewed here to exhibit the relevance of the present study in the present context with regard to consumption on durables, non-durables and services. Gupta (1968) examined the differences in consumption pattern of the households in UP and Madras. The following model was used to estimate the effects of household size on consumption.

$$\log Y = a + b \log X + c \log N + u$$

In the above equation, the parameters b and c are interpreted as partial elasticities of Y with respect to X and N , respectively. This study concluded that the expenditure elasticity for the rural sector was higher when compared to the urban sector and an inverse relation was observed with respect to expenditure elasticities and family size.

Brown and Deaton (1972) estimated Engel elasticities using the following functional forms:

(a) $\log q_i = \alpha_i + \beta_i \log \mu$ (Double log : constant elasticity form).

(b) $q_i = \alpha_i + \beta_i \mu$ (Linear form : elasticity around unity).

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(c) $q_i = \alpha_i + \beta_i \log \mu$ (Semi-log : elasticity continuously declines towards zero).

(d) $\log q_i = \alpha_i + \beta_i \log \mu^{-1}$ (log reciprocal : demand approaches separation).

Limbagoud (2010) estimated expenditure elasticities based on the time-series data by fitting the following double-log function:

$$\log_e \text{CE/Pop} = a + b \log_e \text{TE/Pop}$$

The study concluded that the expenditure elasticity of demand for food during 1950-51 to 2007-08 conformed to the Engel's law.

METHODOLOGY AND DATABASE

Elasticity measures the sensitivity of one variable to another. Specifically, it is a number that tells us the percentage change that will occur in one variable in response to a one per cent increase in another variable. For example, the price elasticity of demand measures the sensitivity of quantity demanded to price changes. It tells us what would be the percentage in the quantity demanded for a good following a one per cent change in the price of that good. The estimation of expenditure elasticity requires data on expenditure incurred on a particular commodity and the total expenditure incurred on all commodities. Expenditure elasticity deals with an increase in commodity groups with respect to an increase in total consumption expenditure, being other things remaining constant. Let us suppose the expenditure on commodity groups is Y_i and the total expenditure is X . Then expenditure elasticity would be:

$$\eta_E = \frac{dY_i/Y_i}{dX/X} \quad (1)$$

The expenditure elasticity (η_E) can be either positive (normal good) or negative (inferior good). Economists divide normal goods into two subgroups: just normal and ultra-superior (or luxuries). If the expenditure elasticity is positive and lies between zero and unity ($0 < \eta_E < 1$), then the quantity demanded rises by a smaller percentage than the total expenditure, implying that consumers do not spend much of any increase in total expenditure on this particular commodity; if $\eta_E > 1$, then the quantity demanded rises by a larger percentage than the total expenditure, implying that quantity demanded is quite responsive to changes in total expenditure. The former commodities are often called necessities and the latter are called luxury goods. If the commodity is inferior, the expenditure elasticity is negative ($\eta_E < 0$). The classification of goods as per the elasticity coefficient is presented in the Table 1.

Table 1: Classification Of Commodities As Per Expenditure Elasticity	
The elasticity coefficient	Nature of commodity
Positive ($0 < \eta_E < 1$)	Normal and a "Necessity"
Positive ($\eta_E > 1$)	Normal and a "Luxury"
Negative ($\eta_E < 0$)	Inferior
Source: Gujarati (1992). 'Essentials of Econometrics.' pp. 218-225	

A number of researchers in the field of consumer behavior have experimented with specifications of functional forms. There are a variety of functional form models, each having special applications. Some of the functional forms are presented in the Table 2. A Linear function is the simplest of all as regards to estimation and interpretation of its parameters. It satisfies the adding-up, homogeneity and symmetry condition. It also assumes constancy of marginal propensity to consume. The magnitude of expenditure elasticity varies directly with the per capita total expenditure (X) and inversely with the specific item or group of commodities expenditure (Y). Besides, it implies that expenditure elasticity tends to unity as income/total expenditure tends to infinity. Double-log is the most popular in two parameter forms. The expenditure elasticity (b_1) is constant at all levels of income/total expenditure. It also provides an automatic correction for heteroscedasticity of disturbances. Let us examine the following 'constant elasticity type' expenditure function.

$$Y_i = b_0 \cdot X^{b_1} \quad (2)$$

Table 2: Functional Forms		
Model	Form	Elasticity = $\frac{dY}{dX} \cdot \frac{X}{Y}$
Linear	$Y = b_0 + b_1 X$	$b_1 (X/Y)^*$
Log-linear (Double log)	$\ln Y = b_0 + b_1 \ln X$	b_1
Log-lin	$\ln Y = b_0 + b_1 X$	$b_1 (X)^*$
Lin-log	$Y = b_0 + b_1 \ln X$	$b_1 (1/Y)^*$
Reciprocal	$Y = b_0 + b_1 (1/X)$	$-b_1 (1/XY)^*$
Note: * indicates that the elasticity coefficient is variable, depending on the value taken by X or Y or both. When no X and Y are specified, in practice, these elasticities are often measured at the mean values of X- and Y-.		
Source : Gujarati(1992). 'Essentials of Econometrics.' p. 241		

Where,

Y_i = Expenditure on i^{th} commodity groups;

X = Total expenditure on all commodities.

The term 'constant elasticity expenditure function' is due to the fact that in this form, the coefficient b_1 is the elasticity of expenditure which is assumed to remain constant. It will be proved that b_1 is the constant elasticity of expenditure. Expressing the above expenditure function in the logarithms of the variables, we obtain:

$$\log Y_i = \log b_0 + b_1 \log X \quad (3)$$

The derivative value of the function with respect to the total expenditure (X) is :

$$d \log Y_i / d \log X = b_1 \quad (4)$$

From a basic property to logarithms, it is known that the change of the logarithm of a variable is equal to the proportionate change of the variable. Applying this to the above derivative, we obtain:

$$d \log Y_i = d Y_i / Y_i \text{ and } d \log X = d X / X \quad (5)$$

and by substituting in equation 4, we have :

$$d Y_i / Y_i / d X / X = b_1 \quad (6)$$

Clearly, b_1 is the elasticity of expenditure:

$$\eta_E = d Y_i / Y_i / d X / X = d Y_i / d X \cdot X / Y_i = b_1 \quad (7)$$

Since b_1 is constant in the formulation of the expenditure function, the elasticity of expenditure is constant.

In this study, instead of using per capita income, per capita total expenditure is used as a proxy variable, which is considered to be the most important factor affecting expenditure for most of the consumption items. The following forms of constant elasticity form of equations have been fitted to time series data using Ordinary Least Squares (OLS) method.

$$\begin{aligned} \log CD/Pop &= b_0 + b_1 \log TPFCE/Pop \\ \text{Or} \\ \log PCCD &= b_0 + b_1 \log PCTPFCE \end{aligned} \quad (8)$$

Where,

$CD/Pop = PCCD$ = per capita real expenditure on durable commodity groups ;

$TPFCE/Pop = PCTPFCE$ = per capita real total consumption expenditure on all commodity groups.

$$\begin{aligned} \log CND/Pop &= b_0 + b_1 \log TPFCE/Pop \\ \text{Or} \\ \log PCCND &= b_0 + b_1 \log PCTPFCE \end{aligned} \quad (9)$$

Where,

$CND/Pop = PCCND$ = per capita real expenditure on non- durable commodity groups.

$TPFCE/Pop = PCTPFCE$ = per capita real total consumption expenditure on all commodity groups.

$$\log CS/Pop = b_0 + b_1 \log TPFCE/Pop$$

Or

Table 3 : Commodity Group Consumption Expenditure (1950-51 to 2007-08) (₹ In crores)									
Pre-reform Period (1950-51 to 1989-90)									
Year	Durables	Non-durables	Services	PFCE	Year	Durables	Non-durables	Services	PFCE
1950-51	4273	158913	39333	207559	1980-81	14485	394499	123928	560718
1951-52	4414	165794	40247	220752	1981-82	15451	409582	129795	583839
1952-53	5811	172166	41161	229660	1982-83	16733	406569	135388	588909
1953-54	5932	184528	42480	243467	1983-84	18370	441314	143901	635334
1954-55	6186	190766	43630	251454	1984-85	19053	449138	150894	651495
1955-56	6518	190358	45427	253858	1985-86	20677	466318	157443	680420
1956-57	6827	199612	46556	265088	1986-87	21955	469581	169847	698991
1957-58	7023	192696	47850	259851	1987-88	22352	480324	179434	721499
1958-59	7377	214380	49211	283706	1988-89	22599	515140	190025	769480
1959-60	7745	214446	51457	286933	1989-90	25008	531908	201591	804428
1960-61	8130	227948	53242	303255	Post-reform period 1990-91 to 2007-08				
1961-62	8172	230918	55318	308425	1990-91	25911	556696	216458	843556
1962-63	8603	232344	57008	312443	1991-92	25468	563447	222854	860869
1963-64	8478	240573	60177	324066	1992-93	25449	567496	233308	879689
1964-65	9038	256224	63006	343425	1993-94	26973	597341	239642	918944
1965-66	8935	253430	65614	343729	1994-95	28048	614924	258796	961346
1966-67	9498	254938	68639	348196	1995-96	31364	642143	278786	1018423
1967-68	9755	271540	70683	367895	1996-97	33446	693618	299438	1097390
1968-69	10349	277996	73726	377559	1997-98	35375	692552	317589	1122195
1969-70	10834	287956	76793	391582	1998-99	38259	733665	336402	1190267
1970-71	12051	295615	78781	404880	1999-00	40939	757591	361398	1257541
1971-72	12906	297535	82250	412758	2000-01	43899	741465	397131	1292986
1972-73	13142	296688	85268	415523	2001-02	45439	776203	423155	1367758
1973-74	12796	304473	88725	425720	2002-03	47274	753392	461415	1397069
1974-75	12751	300940	91626	425399	2003-04	51077	816122	493043	1501974
1975-76	13628	321882	94599	449557	2004-05	57323	823636	538865	1584690
1976-77	14413	322572	99300	458521	2005-06	63953	885999	557942	1692194
1977-78	15036	353515	102876	495910	2006-07	71344	925175	603760	1800874
1978-79	15561	376665	108701	526219	2007-08	78382	985651	646829	1946780
1979-80	14749	357698	116193	514416					
Source: National Accounts Statistics Back Series (1950-51 to 2007-08), MOSPI, GOI, 2008.									
Note: Durables: Expenditure on durables includes furniture, furnishing and appliances.									
Non-durables: Expenditure on non-durables includes food, beverages and tobacco, clothing and footwear and fuel and power.									
Services: Expenditure on services includes gross rent, medical care and health care, transport and communication, recreation, education and cultural services.									
PFCE: Total private final consumption expenditure in domestic market includes miscellaneous expenditure on goods and services which the researcher excluded from the above categories.									

$$\log PCCS = b_0 + b_1 \log PCTPFCE \quad (10)$$

Where,

$CS/Pop = PCCS$ = per capita real expenditure on services commodity groups;

$TPFCE/Pop = PCTPFCE$ = per capita real total consumption expenditure on all commodity groups.

The time-series data on Private Final Consumption Expenditure (PFCE) of commodity groups in the domestic market, consumption expenditure on durables, non-durables and services and population figures during the period from 1950-51 to 2007-08 at 1999-00 prices was gathered from the National Accounts Statistics back series 2008, MOSPI. The PFCE at current prices implicitly includes changes in prices and changes in quantities consumed. Therefore, to correct the data to eliminate the change in prices, the time-series data at the 1999-00 prices was taken.

COMMODITY GROUP CONSUMPTION PATTERN IN INDIA

The pattern of consumption expenditure on commodity groups over a period of time gives a broad idea of the change in household consumption levels and style. It is due to an increase in earnings that the consumption pattern of the people changes over a period of time. In order to examine this, the data collected on durables, non-durables, services and total private final consumption expenditure in domestic market at the 1999-00 prices for the period from 1950-51 to 2007-08 has been sub - divided in into the pre-reform period (1950-51 to 1989-90) and the post-reform period (1990-91 to 2007-08). The data on the commodity group, i.e., durables, non-durables, services and total private final consumption expenditure has been presented in the Table 3. The commodity group expenditure as a percentage of total private final consumption expenditure has been depicted in the Table 4. It can seen from the Table 4 that the

Table 4 : Commodity Group Expenditure As A Percentage To Total Private Final Consumption Exp.								
Durables			Non-durables			Services		
Pre-reform		Post-reform	Pre-reform		Post-reform	Pre-reform		Post-reform
1950-51to 1969-70	1970-71to 1989-90	1990-91 to 2007-08	1950-51to 1969-70	1970-71to 1989-90	1990-91 to 2007-08	1950-51to 1969-70	1970-71to 1989-90	1990-91 to 2007-08
2.06	2.98	3.07	76.56	73.01	65.99	18.95	19.46	25.66
2.00	3.13	2.96	75.10	72.08	65.45	18.23	19.93	25.89
2.53	3.16	2.89	74.97	71.40	64.51	17.92	20.52	26.52
2.44	3.01	2.94	75.79	71.52	65.00	17.45	20.84	26.08
2.46	3.00	2.92	75.87	70.74	63.96	17.35	21.54	26.92
2.57	3.03	3.08	74.99	71.60	63.05	17.89	21.04	27.37
2.58	3.14	3.05	75.30	70.35	63.21	17.56	21.66	27.29
2.70	3.03	3.15	74.16	71.29	61.71	18.41	20.74	28.30
2.60	2.96	3.21	75.56	71.58	61.64	17.35	20.66	28.26
2.70	2.87	3.26	74.74	69.53	60.24	17.93	22.59	28.74
2.68	2.58	3.40	75.17	70.36	57.35	17.56	22.10	30.71
2.65	2.65	3.32	74.87	70.15	56.75	17.94	22.23	30.94
2.75	2.84	3.38	74.36	69.04	53.93	18.25	22.99	33.03
2.62	2.89	3.40	74.24	69.46	54.34	18.57	22.65	32.83
2.63	2.92	3.62	74.61	68.94	51.97	18.35	23.16	34.00
2.60	3.04	3.78	73.73	68.53	52.36	19.09	23.14	32.97
2.73	3.14	3.96	73.22	67.18	51.37	19.71	24.30	33.53
2.65	3.10	4.03	73.81	66.57	50.63	19.21	24.87	33.23
2.74	2.94		73.63	66.95		19.53	24.70	
2.77	3.11		73.54	66.12		19.61	25.06	
Source: National Accounts Statistics Back Series (1950-51 to 2007-08), MOSPI, GOI, 2008.								

expenditure on durables as a percentage of total private final consumption expenditure, TPFCE here after, ranged between 2 to 3 percent in the pre-reform period, but it gradually increased from 3 to 4 percent in the post reform period. The expenditure on non-durables commodity groups which includes food, beverages, pan and intoxicants, and non-food items clothing, footwear, fuel and power, liquefied petroleum gas, kerosene etc., declined very significantly as a percentage of TPFCE. The expenditure on non-durables as percentage of TPFCE decreased from 73 percent in 1950-51 to 66 percent in 1989-90 and further, it declined to 50 percent by 2007-08. A sharp increase in expenditure on services as a percentage of TPFCE was found during the reference period under study. During the pre-reform period, it increased from 19 percent in 1950-51 to 25 percent by 1989-90 and further, it increased from 25 percent in 1990-91 to 33 percent by 2007-08 during the post reform period.

RESULTS AND DISCUSSION

The estimates of expenditure elasticities for commodity groups have been presented in the Table 5. It is evident from this table that the expenditure elasticity for the non-durables commodity groups which includes food, beverages, pan and intoxicants, and non-food items such as clothing, footwear, fuel and power is found to be less than zero (0.71 during the pre-reform period, 0.45 during the post-reform period and 0.60 during 1950-51 to 2007-08) and hence, these commodities fall under the category of the necessary commodity group. As mentioned earlier, if the expenditure elasticity is positive and lies between zero and unity, the consumers do not spend much of any increase in total expenditure on this particular commodity. The sign and magnitude of elasticity of non-durable commodity groups found in the reference period of the study declined very significantly as the total expenditure increased.

On the other hand, expenditure elasticity for services which include gross rent, medical care and health care, transport and communication, recreation, educational and cultural services and expenditure elasticity for durables, which includes furniture, furnishing and appliances is found to be more than one. It implies that expenditure on these commodity groups increased during the period from 1950-51 to 2007-08, and hence, these commodity groups fall under the luxuries or ultra superior goods. A very high expenditure elasticity was observed for these commodity groups during the period under study, which amply supports the well-known Engel's law, which states that the percentage of income spent on food declines, and the percentage income spent on other durables increases, as income increases. The higher proportion of expenditure on education, medical care and health care by parents signifies their attention towards the betterment of their children. Now-a- days, people are very cautious about health and hygiene. Further, very high expenditure elasticities for durables and services signifies an increase in the standard of living of the people over the referred period.

Table 5 : Commodity Group Expenditure Elasticities						
	Per capita Expenditure elasticity			R ²		
	Pre-reform period	Post-reform period	Study period	Pre-reform period	Post-reform period	Study period
Commodity Group	1950-51 to 1989-90	1990-91- 2007-08	1950-51 to 2007-08	1950-51 to 1989-90	1990-91- 2007-08	1950-51 to 2007-08
Durables	1.56 (16.753)	1.60 (44.194)	1.40 (42.121)	0.88	0.99	0.97
Non-durables	0.71 (37.905)	0.45 (13.284)	0.60 (50.198)	0.97	0.92	0.98
Services	1.79 (28.774)	1.58 (31.072)	1.73 (16.753)	0.96	0.98	0.99
	n=40	n=18	n=58			
Source: National Accounts Statistics Back Series (1950-51 to 2007-08), MOSPI, GOI, 2008. Figures in the parentheses represent 't' values and are significant at 1 percent.						

The following equations are used to estimate expenditure elasticity:

For durables: $\log PCCD = b_0 + b_1 \log PCTPFCE$

For non-durables: $\log PCCND = b_0 + b_1 \log PCTPFCE$

For Services: $\log PCCS = b_0 + b_1 \log PCTPFCE$

Table 6 : Growth Rates Of Commodity Groups			
	Growth rate		
	Pre-reform period	Post-reform period	Study period
Commodity Group	1950-51 to 1989-90	1990-91-2007-08	1950-51 to 2007-08
Durables	1.74	4.9	2.23
Non-durables	0.73	1.4	0.96
Services	1.98	4.9	2.77
All commodities	1.06	3.1	1.58
Source: National Accounts Statistics Back Series (1950-51 to 2007-08), MOSPI, GOI, 2008.			
Note: The growth rate is estimated from			
a) $\log PCCD = b_0 + b_1 t$; b) $\log PCCND = b_0 + b_1 t$; c) $\log PCCS = b_0 + b_1 t$			
d) $\log PCTPFCE = b_0 + b_1 t$			

The growth rate estimation of commodity groups is depicted in the Table 6. It can be observed that the estimated growth rate of the non-durables commodity group is 0.73 in the pre-reform period, 1.4 in the post reform period and 0.96 during the period under study, which is lower than the growth rate estimated for total expenditure (1.06, 3.1 and 1.58). The growth rates estimated for durables and services are higher than the estimated growth rate of total expenditure. The growth rates estimated for commodity group services registered a high and significant growth rate when compared to all other commodities as a group.

CONCLUSION

Elasticity measures the sensitivity of one variable to another. Specifically, it is a number that tells us the percentage change that occurs in one variable in response to a one per cent increase in another variable. Keeping this in view, an attempt is made in the present study to estimate expenditure elasticities of commodity groups comprising of durables, non-durables and services for the Indian economy during the period from 1950-51 to 2007-08 at 1999-00 prices. In this study, the expenditure elasticity for non-durables commodity group which includes food, and other food-related items is found to be less than unity, corroborating the well-known Engel's law, implying food is a necessity for all time. The expenditure elasticity for commodity groups consisting of durables and services was found to be at a higher rate than unity and turned out to be luxuries or ultra-superior commodities. The proportion of expenditure incurred on medical care and health services, transport and communication and education and cultural services increased as total expenditure increased and aligned with Engel's law.

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