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INCOME AND PRICE EFFECTS ON DEMAND FOR FOODGRAINS

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AN attempt has been made in this paper to ascertain the effects of income and prices on consumption of foodgrains by analysing the family budget data obtained by the Directorate of National Sample Survey in their various rounds. First the data collected in the 10th round in 1955-56 are analysed to estimate the income effect. Then, the data of the different rounds conducted in the period 1951-52 to 1955-56 were put together to constitute what is called a "combination of cross section and time series data." The analysis of the combined data was done to estimate both the income effect and price effect. The analysis of the 10th round data was done for urban India, while that of the combined data for different rounds was done for both urban and rural India. These data for 10th round (urban India) are given in Table I.

The N. S. S. data on household budgets relate to total expenditure per person instead of total income. The data of foodgrains relate to expenditure on foodgrains and not to quantity of foodgrains consumed. As such, the functions to be fitted would describe the relationship between total expenditure and expenditure on foodgrains.

In analysing the data, the method of weighted least squares rather than the ordinary least squares, has been used, the weight for each income class being the proportion of sampled population belonging to that income class.

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TABLE I—CONSUMER EXPENDITURE IN RUPEES, PER CAPITA PER MONTH AND HOUSEHOLD SIZE FOR ALL-INDIA URBAN AREAS OBTAINED IN NATIONAL SAMPLE SURVEY, 10TH ROUND, 1955-56

Expenditure class Rs.	Distribution of number of persons (in per cent)	Expenditure on foodgrains (average for each class) Rs.	Expenditure on all goods and services (average for each class) Rs.	Average household size (number of persons)
0 — 8	4·33	3·26	6·33	4·90
8 — 11	12·32	4·34	9·44	5·22
11 — 13	9·41	4·63	12·01	5·72
13 — 15	7·68	5·29	14·02	5·50
15 — 18	12·87	5·14	16·32	5·33
18 — 21	10·28	6·01	19·38	4·83
21 — 24	7·19	5·87	22·70	4·90
24 — 28	8·21	6·69	25·94	3·87
28 — 34	8·20	6·67	31·18	4·21
34 — 43	7·63	6·50	38·00	3·46
43 — 55	5·51	7·08	48·48	2·87
55 and above	6·38	7·97	88·13	2·34
	100·00			

To begin with, the function of the type

$$Y = a + b_1 \text{ Log } X_1 + b_2 X_2 + u$$

was fitted to the above data, where

Y = Expenditure on foodgrains
X_1 = Total expenditure
X_2 = Household size
u = random error term, $N(0, \sigma^2)$

The assumption in this function is that equal *absolute* change in household size results in equal absolute change in foodgrains expenditure, while equal *percentage* change in total expenditure results in equal absolute change in foodgrains expenditure. The household size is assumed to have a *constant* marginal effect on foodgrains expenditure, while the total expenditure is assumed to have a *diminishing* marginal effect on foodgrains expenditure. The fitted equation worked out to be

$$Y = a + 1.8312 \log X_1 + .0760 X_2 \qquad \text{......(i)}$$

The main interest in fitting this function was to see if the household size had any significant effect on foodgrains expenditure. That is to say, whether there were any scale economies in foodgrains expenditure. In the fitted function (i) the coefficient of X_2 has a plus sign which shows that an increase of 1 person in the average household size, instead of resulting in a decrease in foodgrains expenditure, caused an increase of Re.0.076 in the foodgrains expenditure per person per month. This is not in accord with economic reasoning. In any case, the effect of household size on foodgrains expenditure is negligible and the coefficient is also statistically insignificant. This shows that the household size has no significant influence on foodgrains expenditure and this variable can be omitted from further analysis.

Next, a few functions were fitted to the same data with foodgrains expenditure as the dependent variable and total expenditure as independent variable, the household size being excluded. The functions are :

1. $Y = a \frac{X}{X + b}$ (Tornquist function)

2. $Y = a + b \log X$ (Semi-log)

TORNQUIST FUNCTION

The tornquist function $Y = a \frac{X}{X + b}$ was first transformed into the linear form

$$Z = \frac{b}{a} + \frac{1}{a} X \qquad \text{.............................(ii)}$$

where $Z = \frac{X}{Y}$. This transformed function was fitted by weighted regression.

The fitted equation worked out to

$$Z = 1.1724 + \underset{(.0000007)}{.1139\, X} \qquad \text{.............................(iii)}$$

$$r^2_{Z \cdot X} = 0.995$$

The figure in bracket denotes the standard error of the coefficient of X. It is just negligible. $r^2_{Z \cdot X}$ is 0.995 which means that the equation explains 99.5 per cent of the variations in Z, *i.e.*, $\frac{X}{Y}$ (not Y). These statistics show the remarkable success, with which the Tornquist function explains consumer behaviour.

Equation (iii) can easily be converted back into the original function; it works out to

$$Y = 8.777 \frac{X}{X + 10.2902} \qquad \text{.............................(iv)}$$

$r^2_{Y \cdot X}$, the coefficient of determination between Y and X comes to 0.950. This means that equation (iv) is successful in explaining 95 per cent of the variations in Y (expenditure on foodgrains).

The result obtained in equation (iv) can be interpreted in a number of ways. Firstly, the increase in foodgrains expenditure resulting from a unit increase (say, Re. 1) in the total expenditure is given by the first derivative:

$$\frac{dy}{dx} = \frac{d}{dx}\left(8.777\,\frac{X}{X + 10.2902}\right) =$$

$$= \frac{(8.777)\,(10.2902)}{(X + 10.2902)^2} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(v)}$$

Expression (v) gives the marginal propensity of foodgrains expenditure in relation to total expenditure. It will be noticed that this marginal propensity depends on the level of total expenditure (X) already attained. As total expenditure goes up, any addition to it is devoted to foodgrains to a diminishing extent. As X enters (v) in the denominator with a squared term, the diminution takes place rather rapidly.

Secondly, if one wants to know the effect of 1 *per cent* increase in total expenditure (instead of a unit increase, say of Re. 1), it would be given by the expression :

$$\frac{(8.7777)\,(10.2902)\,X}{100\,(X + 10.2902)^2} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(vi)}$$

Thirdly, it may be desired to know the *percentage increase* in foodgrains expenditure resulting from 1 per cent *increase* in total expenditure. This is the elasticity of foodgrains expenditure, in relation to total expenditure. This is given by

$$\frac{10.2902}{X + 10.2902} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(vii)}$$

Expression (vii) shows that even elasticity diminishes as the level of total expenditure increases. This is an important attribute of the Tornquist function which makes it very suitable for describing the behaviour of consumers of a necessity like foodgrains. Of course, the elasticity diminishes at a lesser rate than the rate of diminution of marginal propensity.

SEMI-LOG FUNCTION

The semi-log function fitted to the same data worked out to be

$$Y = 0.52132 + \underset{(.019115)}{1.7267}\,\text{Log}\,X \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(viii)}$$

$$r^2_{y.\text{Log}\,X} = .941$$

The figure in brackets represents the standard error of the coefficient of log X. This again is negligible in relation to the value of the coefficient, which shows that the coefficient is highly significant. r^2 being .941, about 94 per cent of the variations in Y (foodgrain expenditure) are explained by the equation.

In terms of this function, the increase in foodgrains expenditure resulting from an increase of Re. 1.00 in the total expenditure(*i.e.*, marginal propensity of foodgrains expenditure) is given by the expression :

$$\frac{dy}{dx} = \frac{1.7267}{X} \text{ rupees} \qquad \text{.....................(ix)}$$

As X increases, the marginal propensity decreases.

The effect of 1 *per cent* increase in total expenditure is given by

$$\frac{1.7267}{100} = .017 \text{ rupee} \qquad \text{.....................(x)}$$

which is constant for all levels of expenditure.

Elasticity of foodgrains expenditure to total expenditure is expressed by

$$\eta = \frac{1.7267}{Y} \qquad \text{.....................(xi)}$$

Thus elasticity is inversely proportional to foodgrains expenditure and not to total expenditure. Thus the semi-log function also gives diminishing elasticity, though the rate of diminution is less than the rate of diminution in the case of the Tornquist function, because Y increases at a less rate than X.

Double-Log Function

The double-log function fitted to the same sample worked out to be

$$\text{Log } Y = .5545 + \underset{(.00459)}{0.3845} \log X \qquad \text{.....................(xii)}$$

$$r^2 = .767$$

This function can also be written as

$$y = 1.741 X^{0.3845} \qquad \text{.....................(xiii)}$$

The coefficient of log X (.3845) is very significant, as it has a negligible standard error. r^2 is .767, which means that the function explains 76.7 per cent of the variation in log Y, *i.e.*, logarithms of foodgrains expenditure.

As for the variations in Y, *i.e.*, the foodgrains expenditure itself (not log Y), these are explained by the functions to the extent of about 90 per cent.

In terms of this function, the increase in foodgrains expenditure resulting from an increase of Re. 1 in the total expenditure (*i.e.*, marginal propensity of foodgrains expenditure) is given by the expression

$$\frac{dy}{dx} = 0.3845 \frac{Y}{X} \qquad \text{.....................(xiv)}$$

The effect of 1 per cent increase in total expenditure is given by

$$\frac{0.3845 Y}{100} \qquad \text{.....................(xv)}$$

The elasticity of foodgrains expenditure to total expenditure is, of course, the coefficient of log X, *viz.*, 0.3845, which is constant for all values of X. That is why, the double-log curve is also known as the constant-elasticity curve.

It will be clear from the above interpretations that the marginal propensity to consume or elasticity varies according to the level of expenditure. The co-efficients/elasticities at different expenditure levels are given below.

Total expenditure level (Rs.)	Absolute increase in Y against a unit absolute increase in X (marginal propensity to consume) (Rs.)			Absolute increase in Y against a unit *per cent* increase in X (Rs.)			Percentage increase in Y against a unit *per cent* increase in X (elasticity)		
	Torn-quist	Semi-log	Double log	Torn-quist	Semi-log	Double log	Torn-quist	Semi-log	Double log
20	·098	·086	·111	·020	·017	·022	·34	·30	·38
25	·072	·069	·096	·018	·017	·024	·29	·28	·38
30	·056	·058	·084	·017	·017	·025	·25	·26	·38
35	·044	·049	·075	·015	·017	·026	·23	·25	·38

Since in many cases the marginal propensity to consume or elasticity is not constant but is a function of the level of X or Y, the additional expenditure on foodgrains resulting from an increase in total expenditure from one level to higher level, say, from Rs. 30 to Rs. 35, would be given by "integrating" the respective functions. Thus, in the case of Tornquist function, the effect of an increase of Re. 1 in total expenditure on foodgrains expenditure is given by the expression (v)

$$\frac{(8.777)\ (10.2901)}{(X + 10.2902)^2}$$

The increase in foodgrains expenditure (in Rs.) resulting from an increase of Rs. 5 in the total expenditure from Rs. 30 to Rs. 35 would be given by

$$\int_{30}^{35} \frac{(8.777)\ (10.2902)}{(X + 10.2902)^2}\, dX = \left(\frac{-(8.777)\ (10.2902)}{(X + 10.2902)} \right)_{30}^{35} = \text{Re. } 0.2475$$

In determining the *per cent* increase in foodgrains expenditure resulting from say, a 10 per cent increase in total expenditure from a level of Rs. 30.00, it is better to use the marginal propensity expression (v) rather than the elasticity expression (vii). First the absolute increase in foodgrains expenditure is determined by the expression

$$\left(\frac{-(8.777)\ (10.2902)}{(X + 10.2902)} \right)_{30}^{33}$$

which comes to Re. 0.15; then the amount of foodgrains expenditure as against the total expenditure of Rs. 30.00 is determined from expression (vi). This comes to Rs. 6.58. Thus the 10 per cent increase in total expenditure from a level of Rs. 30.00 results in an increase of $\frac{(0.15 \times 100)}{6.58} = 2.3$ per cent in foodgrains expenditure. An approximate result can also be arrived at by calculating the elasticity from expression (vii) at the total expenditure level of Rs. 30.00 and multiplying it with the per cent increase in total expenditure. This works out to $10 \times 0.25 = 2.5$ per cent. But this is only an approximation, the exact result being 2.3 per cent. When the per cent increase in total expenditure is large, the difference between the two results becomes significant.

EFFECT OF PRICES

As already explained, the effect of prices of foodgrains on the demand for them has been determined by building up a time series from the cross-sectional data collected in different rounds in different years. In all, the data for 8 rounds from 3rd to 10th were combined. The following variables, again for urban India, were used :

- Y : Foodgrains expenditure for each of the 12 income classes and for each of the 8 survey rounds, *i.e.*, a total of 96 observations.
- X_1 : Total expenditure for each of the 12 income classes and for each of the 8 survey rounds, *i.e.*, a total of 96 observations.
- X_2 : Wholesale price index of foodgrains for the months for which the sample survey in a particular round was conducted. There would thus be 8 observations, each of which will be repeated 12 times, to make a total of 96 observations. It would have been better to take retail prices. But no all-India index of retail prices is available.[1]

The function fitted to these data was of the type

$$Y = a + b_1 \log X_1 + b_2 \log X_2$$

which implies that a given percentage change in X_1 or X_2 results in a given absolute change in Y. The fitted function worked out to be

$$Y = 12.65 + \underset{(.00054)}{1.91} \log X_1 + \underset{(.1478)}{2.87} \log X_2 \quad r^2 = 0.83 \quad \text{.........................(xvi)}$$

The effect of a unit change in X_1 (say Re. 1) on Y is given by the partial derivative of Y with respect to X_1.

$$\frac{\partial Y}{\partial X} = \frac{1.91}{X_1} \text{ rupees} \quad \text{.........................(xvii)}$$

The effect of 1 per cent change in X_1 on Y is given by

$$\frac{1.91}{100} \text{ rupees} = 1.91 \text{ nP.}$$

The effect of 1 per cent change in X_1 on per cent change in Y is given by

$$\eta_1 = \frac{1.91}{Y} \quad \text{.........................(xviii)}$$

1. It is assumed that wholesale and retail prices have moved in step with each other over time. If this assumption is correct, then the estimate of elasticity would not differ whether retail prices or wholesale prices are used.

Where η_1 is the elasticity of foodgrains expenditure with respect of total expenditure. At the average value of Y for the series being analysed, *viz.*, Rs. 6.13, the elasticity works out to 0.31.

Similarly, the effect of unit change in X_2 (say 1 point in the wholesale price index for foodgrains) on Y is given by the partial derivative of Y with respect to X_2

$$\frac{\partial Y}{\partial X_2} = \frac{2.87}{X_2} \qquad \text{(xix)}$$

The effect of 1 per cent change in X_2 on Y is given by

$$\frac{2.87}{100} \text{ rupees} = 2.87 \text{ nP.}$$

The effect of 1 per cent change in X_2 on per cent change in Y is given by

$$\eta_2 = \frac{2.87}{Y} \qquad \text{(xx)}$$

where η_2 is the elasticity of foodgrains expenditure with respect to foodgrains prices. At the average value of Y for the series, the elasticity works out to 0.47.

It would be observed that the elasticity of foodgrains *expenditure* with respect to total expenditure at the average value of Y by applying the semi-log functional form, *viz.*, 0.31 is close to that worked out on the basis of 10th round data alone by applying the same functional form.

As for the elasticity of foodgrains expenditure with respect to foodgrains prices, the computed figure of 0.47 may be interpreted to embody four effects:

1. The direct effect of prices (D); normally 1 per cent increase in foodgrains prices should result in a 1 per cent increase in foodgrains expenditure, if other effects of price change are absent. Actually, it results in 0.47 per cent increase in foodgrains expenditure, instead of 1 per cent. This shows that there are other factors with negative effect.

2. Income-effect (K); a 1 per cent increase in foodgrains prices results in a decrease in real income and so a decline in the quantity of foodgrains consumed.

3. Substitution effect, external (S_E); that is to say, the decrease in quantity of foodgrains consumed as a result of 1 per cent increase in price. This substitution effect may be called the external substitution effect because it relates to the tendency of consumers to shift from foodgrains to other commodities as a result of a 1 per cent increase in foodgrains prices.

4. Substitution effect, internal (S_1); that is to say the substitution within the foodgrains group from costlier foodgrains to cheaper foodgrains as a result of a 1 per cent increase in the prices of foodgrains as a whole. (This assumes a proportionate increase in the different prices of foodgrains).

These four effects can be expressed in algebraic form as

$$\eta_2 = D + K + S_E + S_1$$

or

$$0.47 = 1 + K + S_E + S_1$$

or

$$(K + S_E) + S_1 = -0.53^* \qquad \text{(xxi)}$$

* This is approximate, because the elasticities which are in percentage terms cannot be straightaway added.

In expression (xxi), $(K + S_E)$ represent the per cent decline *in quantity* of foodgrains consumed as a result of 1 per cent increase in the prices of foodgrains, while S_1 represents the per cent decline in foodgrains expenditure brought about by a shift within the foodgrains group to cheaper foodgrains, (without affecting quantity of foodgrains as a whole) as a result of 1 per cent increase in foodgrains prices. Thus + 0.47 is the elasticity of foodgrains *expenditure* in relation to foodgrains price and —0.53 is the elasticity of quantity of foodgrains consumed + S_1 (*i.e.*, internal substitution effect). As these two components cannot be separated the quantity elasticity of demand for foodgrains with respect to price cannot be determined. If the data on the quantity of different foodgrains consumed were available, it would be possible to estimate the elasticity of foodgrains consumed with respect to price, as in that case the internal substitution effect which would relate to changeover from one quality of a foodgrain to another quality of the same foodgrain and not to changeover from one foodgrain to another, will be relatively small.

ANALYSIS FOR RURAL INDIA

The preceding analysis related to consumer data for urban areas. The situation in rural areas is considerably different from that in urban areas. Firstly, foodgrains play a more important role in the dietary and the expenditure pattern in rural areas than they do in urban areas. This is mainly because the rural incomes are much below the incomes of urban people. It is for this reason that income-elasticity of foodgrains expenditure in rural areas is believed to be much higher than that in urban areas. Again, bulk of the rural population consists of farmers who meet their requirements of foodgrains out of their own production and in addition sell foodgrains to meet the needs of urban people and the non-producing rural people. A rise in prices of foodgrains which reduces the 'real' income of urban people, has a different effect on the incomes of farmers. As farmers are sellers and not buyers of foodgrains, a rise in prices increases rather than decreases their income. Therefore, the price-elasticity of foodgrains expenditure worked out from rural data has to be interpreted in a different way than was done for urban analysis.

The analysis for rural areas has been done by combining the data for different rounds (third to tenth), so that there were 96 observations of foodgrains expenditure (Y), 96 observations of total expenditure (X_1) and 96 observations of index of foodgrains prices (X_2), *i.e.*, 8 observations of price index, each repeated 12 times. Thus the different variables were just the same as used in the foregoing urban analysis. The price variable was representative by the all-India wholesale price index as for urban analysis. Even though the absolute level of prices would be different in urban and rural areas, the changes in prices over time are assumed to be the same in both urban and rural areas. The type of function used is such that changes in prices are more relevant than absolute level of prices.

The functional form used was also the same, *viz.*, semi-log. The fitted functions worked out to be

$$Y = -33.634 + \underset{(0.17)}{4.290} \log X_1 + \underset{(0.84)}{6.487} \log X_2 \qquad \text{(xxii)}$$

$$r^2 = .88$$

The effect of a unit change in total expenditure (say, Re. 1) on foodgrains expenditure is given by the expression.

$$\frac{4.290}{X_1} \text{ rupees} \qquad \text{(xxiii)}$$

The effect of 1 per cent change in total expenditure on foodgrains expenditure would be

$$\frac{4.290}{100} = 4.3 \text{ nP.} \qquad \text{(xxiv)}$$

The effect of 1 per cent change in total expenditure on per cent change in foodgrains expenditure (*i.e.*, elasticity) is given by

$$\eta'_1 = \frac{4.290}{Y} \qquad \text{(xxv)}$$

At the average value of Y for the series being analysed, *viz.*, Rs. 8.62, the elasticity works out to 0.497 or approximately 0.50.

Similarly, the effect of unit change in price of foodgrains (say, 1 point in the wholesale price index of foodgrains) on foodgrains expenditure is given by

$$\frac{6.487}{X_2} \text{ rupees} \qquad \text{(xxvi)}$$

The effect of 1 per cent change in foodgrains prices on foodgrains expenditure is given by

$$\frac{6.487}{100} = 6.49 \text{ nP} \qquad \text{(xxvii)}$$

The effect of 1 per cent change in foodgrains prices on per cent change in foodgrains expenditure (*i.e.*, elasticity) is given by

$$\eta'_2 = \frac{6.487}{Y} \qquad \text{(xxviii)}$$

At the average value of Y for the series, the elasticity works out to 0.75.

The price elasticity of 0.75 can be interpreted to embody the following effects:

1. Direct effect of prices (D′); normally, as in the case of urban analysis, 1 per cent increase in foodgrains prices should result in a 1 per cent increase in foodgrains expenditure. It may be mentioned that the data relating to foodgrains expenditure for the farmers represented the imputed value of the quantities consumed by them out of their own production.

2. Income effect (K′); in the urban analysis, it was explained that 1 per cent increase in foodgrains prices resulted in a decrease in real income and so a decline in the quantity of foodgrains consumed. This does not hold good for rural analysis. As the rural people are mostly sellers and not buyers of foodgrains, an increase in foodgrains prices does not result in a decline in their real income. It rather results in an increase in their money income which is reflected in the figures for total expenditure and has therefore been taken account of. Thus the income effect in the case of seller-farmers, constituting bulk of population is zero. In the case of deficit farmers and the non-farming population, the income effect of a rise in prices would be there. But for this section of the rural population forming only a small proportion (perhaps, about 10 per cent), the income-effect would be very small.

3. Substitution effect, external (S_E'); as explained in the urban analysis, this effect relates to the tendency of consumers to shift their expenditure from foodgrains to non-foodgrains in the event of a rise in foodgrains prices, relatively to the prices of non-foodgrains. This effect might be present among the farmers, too, who tend to sell more of their production and retain less for own consumption, whenever prices of foodgrains rise. This tendency is often noticed in the case of individual foodgrains and as is shown by the present analysis, seems to be true for foodgrains as a whole also.

4. Substitution effect, internal (S'_I); it was explained in the urban analysis that as the foodgrain prices rose and the real income of consumers declined, they might try to shift to cheaper foodgrains, without reducing the total quantity of foodgrains consumed. In the case of rural population, this substitution effect would be too small, for the same reasons as apply to the price effect.

$$\left.\begin{aligned} \text{Thus } \eta_2 &= D' + K' + S'_I + S'_E \\ \text{or, } 0.75 &= 1 + K' + S'_I + S'_E \\ \text{or, } -0.25 &= K' + S'_I + S'_E \end{aligned}\right\} \qquad \text{.....................(xxix)}$$

In (xxix), 0.75 is the value elasticity of foodgrains expenditure in relation to foodgrains prices, as against 0.47 for urban areas, which means that the increase in foodgrains expenditure (including the imputed value of self-produced consumption) resulting from a 1 per cent increase in foodgrains prices is larger in rural areas than in urban areas. This value elasticity of foodgrains expenditure in relation to foodgrains prices includes the "direct price effect" of an increase in foodgrains prices which is unity for both urban and rural areas, because a 1 per cent increase in foodgrains prices should result in a 1 per cent increase in foodgrains expenditure, in the absence of other effects. The other effects of a price change, which include the income effect and the two substitution effects are, taken together, weaker in rural areas than in urban areas, because an increase in foodgrains prices which reduces the real income of urban consumer and discourages foodgrain consumption, has no such effect on farmers constituting bulk of the rural population. For the same reason, the shift within the foodgrains sector from expensive to cheaper grains is also weaker in rural areas than in urban areas. The combined income and the two substitution effects of a 1 per cent change in foodgrains prices is (—) 0.53 per cent for urban areas and (—) 0.25 per cent for rural areas. The presumption is that the effect of foodgrains price changes on the *quantity* of foodgrains produced is smaller in rural areas than in urban areas. As for the elasticity of foodgrains expenditure in relation to total expenditure, it seems to be about 0.30 for urban areas and 0.50 for rural areas at the average level of expenditure for respective areas. Thus the income-elasticity of demand for foodgrains (in terms of value and quantity) is larger for rural areas; the price-elasticity of demand for foodgrains (in terms of value) is also larger for rural areas but the price elasticity of demand for foodgrains (in terms of quantity) is smaller for rural areas than for urban areas.