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Research Note

Analysis of Demand for Major Spices in India*

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Abstract

India is the largest producer, consumer, and exporter of spices in the world. The demand scenario for major spices in India has been comprehensively examined in the study. The shift in preferences of domestic consumers for food items, increasing urbanization and rising incomes, altered demographic and social factors and the changes in productivity of spices have brought about changes in the pattern of their consumption and demand. A two-stage budgeting framework, which is a recent development in the theory, of demand with quadratic terms of total expenditure / food expenditure and is an appropriate technique for computing the expenditure elasticities, has been employed to work out the expenditure elasticities for spices in India. The resultant expenditure elasticities range between 0.40 and 0.60 and do not show much disparity across different income classes or regions and over the years. Also, the household consumption demand projections for important spices in the country for the years 2005, 2010 and 2015 show that the domestic demand for spices would increase further in the coming years.

Introduction

Spices have been an integral part of the Indian diet, and the demand for spices has been growing year after year. India has certain natural comparative advantages with respect to production and utilization of spices; these include diverse agro-climatic production environments, availability of innumerable varieties and cultivars of each spice suitable for different climatic conditions, cheap labour, large domestic market and a strong tradition of using spices and their products in food, medicine and cosmetics. This is the reason that,

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in almost all the states and union territories of India, at least one spice is grown in abundance. India is not only the largest producer but also the largest consumer of spices in the world. There has been a steady increase in the area and production of spices in India over the years. The annual growth rates in area and production have been estimated to be 3.6 per cent and 5.6 per cent, respectively for the year 2003 (Survey of Indian Agriculture, 2004). In the year 2002, the production of spices in India had reached a level of 3.08 million tonnes on 2.60 million hectares of land (Economic Survey, 2002-03). The major contributors to the area and production of spices in the country include chillies, ginger, turmeric, black pepper, cardamom and garlic. India is also the largest exporter of spices, exporting 0.24 million tonnes of spices, valued at Rs 23 thousand million (around 45 per cent by volume and 25 per cent by value of the world's total spices trade). In addition, the country exports spice oils and oleoresins to the global spices market. Though these account for only 2 per cent of the country's total quantum of spices exports, they contribute about 24 per cent of the total export earnings from spices (2001-02). The major proportion of the spices produced in India is absorbed in the domestic market and only about 10 per cent is exported to over 150 countries.

The pattern of spices production has been changing over time in different regions. The shifts in preferences of domestic consumers, increasing urbanization, rising incomes, demographic and social factors and the changes in productivity of spices have brought about changes in the pattern of consumption and hence the demand for spices. Liberalization of trade under the WTO regime is expected to have a significant impact on the international demand pattern of spices. Relatively little work has been done to comprehensively study the dynamics of demand for spices in India. Hence, the present study was undertaken specifically to (i) estimate demand model and compute demand elasicities of spices, and (ii) project the demand for spices in the medium-term, till the year 2015.

Database

The study used household data on consumer expenditure and consumption pattern from the nation-wide surveys conducted by the National Sample Survey Organization (NSSO). Specifically, household data collected under two major rounds of National Sample Survey (NSS) covering the years, 1987-1988 (July-June) and 1999-2000 (July-June), numbered as 43rd and 55th rounds, respectively were used for the study. The dietary consumption of and expenditure on various spices in the food basket for the rural and urban household levels falling under four income classes, namely,

very poor (below 75% of the poverty line), moderately poor (from 75% below the poverty line to the poverty line), non-poor low (from the poverty line to 150% above the poverty line) and non-poor high (above 150% of the poverty line) were used for carrying out the demand analysis.

Methodology

A multi-stage budgeting framework was used for modelling the consumer behaviour of households consuming spices (Dey, 2000; Jain *et al.,* 1998). The modelling was attempted in two stages (Fig. 1). In the first stage, the household made the decision on how much of their total income was to be allocated for food consumption, and the rest on non-food items, given their household and demographic characteristics. In the second stage, the household allocated a portion of food expenditure to spices consumption.

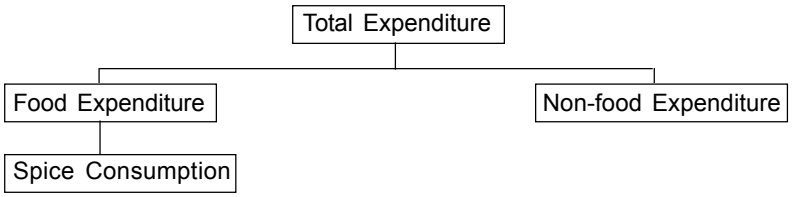

Fig. 1. Budgeting framework for spices

Food Expenditure Function

A double log regression model was fitted the food expenditure as the dependent variable and the variables like price of food, price of non-food, per capita total expenditure, and other socio-demographic variables as the independent variables. The specific model was as given in Eq. (1):

$$\ln(M) = \alpha + \gamma_1 \ln(P_f) + \gamma_2 \ln(P_{nf}) + \beta_1 \ln Y + \beta_2 (\ln Y)2 + \Sigma\theta_i Z \quad \ldots(1)$$

where,

M = Per capita food expenditure

Y = Per capita total expenditure (income)

P_f = Household specific Stone price index for food

P_{nf} = Price index for non-food expenditure, and

Z = Socio-demographic vector (family size, year, and urban dummy).

The food expenditure Eq. (1) was estimated by the ordinary least squares (OLS) method. The condition of homogeneity of degree zero in prices and income was imposed by restricting $\gamma_1 + \gamma_2 + \beta_0 + 2\beta_1 \ln(Y) = 0$ at the sample mean of ln *(Y)*.

Stone index for food was approximated using Eq. (2):

$$\text{In } P_f = \Sigma\ \bar{\omega}_i \ln (p_i) \quad \ldots(2)$$

where,

$\bar{\omega}_i$ = Mean of expenditure share of the ith food item, and

p_i = Price of the ith food item.

Spice Consumption Function

In the second stage, spice consumption function in terms of quantity was specified using Eq. (3):

$$\ln(Q) = \alpha' + \gamma \ln(P_S) + \beta_1 \ln(M) + \beta_2 (\ln M)^2 + \sum \theta' Z \quad \ldots(3)$$

where,

Q = Per capita spice consumed in quantity

P_S = Price of spices

M = Predicted per capita food expenditure from Eq. (1), and

Z = Socio-demographic vector (family size, year and urban dummy).

The spice consumption function (3) was estimated by the OLS method by imposing homogeneity restriction of degree zero in prices and food expenditure at sample mean of ln (M). The data used in the study belonged to the spice consuming population and hence the consumption of spices was non-zero.

Expenditure Elasticities

The expenditure elasticity of food with respect to the total expenditure (income) was directly obtained by differentiating the double log function (Eq.1) as follows:

$$\frac{\partial \ln(M)}{\partial \ln(Y)} = \beta_1 + 2\beta_2 (\ln Y) \quad \ldots(4)$$

where, β_1 is the expenditure elasticity of food with respect to total expenditure (income).

Similarly, the expenditure elasticity of spices with respect to per capita food expenditure was computed from Eq. (3):

$$\frac{\partial \ln(S)}{\partial \ln(M)} = \beta_1 + 2\beta_2 (\ln M) \quad \ldots(5)$$

where, β_1 is the expenditure elasticity of spices with respect to food expenditure.

Finally, the expenditure elasticity of spices with respect to the total per capita expenditure was estimated by Eq. (6):

$$E_{spices}^{exp} = E_{food}^{exp} . E_{spices}^{food} \quad ...(6)$$

where,

E_{spices}^{exp} = Expenditure elasticity of spices with respect to total expenditure

E_{food}^{exp} = Expenditure elasticity of food with respect to total expenditure, and

E_{spices}^{food} = Expenditure elasticity of spices with respect to food expenditure.

Demand Projection

The per capita consumption demand for spices in the t^{th} period was calculated employing the following formulae:

$$d_t = d_0 (1 + d)^t \quad ...(7)$$

$$D_t = d_t \times pop_t \quad ...(8)$$

where,

d_t = Per capita consumption demand for spices in the t^{th} period

d_0 = Per capita consumption of spices in the base period

d = Growth in per capita spices consumption demand

D_t = Total consumption demand for spices in the country, and

pop_t = Projected population of the country in the t^{th} period.

Results and Discussion

The results of the fitted demand model for food expenditure and the spices consumption and the expenditure elasticities estimated from these results, along with the medium-term projections for household consumption demand for major spices, are presented in this section.

Food Expenditure

The estimates of the parameters of the food expenditure function are given in Table 1. The explanatory variables included in the model explained 96 per cent of the total variations in food expenditure (Table 1). The coefficient of food price factor, as expected, was negative and statistically significant. The coefficient of non-food price factor was positive which explained that food and non-food commodities were substitutes. The linear-term of per capita total income variable was positive and significant, indicating

Table 1. Estimated food expenditure function (Stage 1)

Explanatory variable	Regression coefficient	Standard error	*t*- value
Dependent variable: Food expenditure (per capita)			
Intercept	5.0090	0.9317	5.3761
ln (CPI_F)	-0.905**	0.0213	-42.490
ln (CPI_NF)	0.1148**	0.0183	6.2570
ln (EXP1)	1.8935**	0.1007	18.789
ln (EXP2)	-0.121**	0.0105	-11.446
F-size	0.0125*	0.0042	2.9350
UR_D	-0.0561**	0.0057	-9.852
Year	-0.0035**	0.0007	-7.4841
Adjusted R^2	0.9663		

** Shows significance at 1% level; * Shows significance at 5% level
Dependent variable: ln (Per capita expenditure on food/ consumer price index)
Explanatory variables:
ln (CPI_F) = ln (Stone price index for food/ consumer price index general)
ln (CPI_NF) = ln (Stone price index for non-food/ consumer price index general)
ln (EXP1) = ln (Per capita total expenditure (income)/ consumer price index)
ln (EXP2) = ln (EXP1) x ln (EXP1); F-size = Family size
UR_D = Urban dummy (Urban = 1, otherwise = 0); Year = 1987, 1999

that the response of food expenditure to income changes was substantial. The squared term of per capita total income variable was negative and significant, suggesting the existence of a non-linear relationship between the food expenditure and the total income. A positive relation was seen between the number of persons in the family and the food expenditure. There was a negative relation between urban dummy and food expenditure, which indicated that with urbanization the expenditure on food decreased. Also, the food expenditure decreased with time.

Spice Consumption

The estimates of the parameters of the spice consumption function are presented in Table 2. The value of adjusted R^2 was 0.85, indicating a good fit of the model. The coefficient of the food expenditure function was found significant, but its squared-term was not significant. This explained that a linear relationship existed between spices consumption and food expenditure. The coefficient of urban dummy was not significant. The coefficient of year was positive and explained that the overall spice consumption had increased from 1987 to 1999. All the regional dummies were positive and significant, indicating the importance of spices in the consumption basket in

Table 2. Estimated spice consumption function (Stage 2)

Explanatory variable	Regression coefficient	Standard error	*t*- value
Dependent variable: Spice expenditure (per capita)			
Intercept	-9.3821	2.9698	-3.159
ln (SP_P)	-0.6607**	0.0373	-17.70
ln (EXP_F1)	0.4311*	0.4758	0.906
ln (EXP_F2)	0.0364	0.0758	0.481
F_size	-0.0426*	0.0150	-2.829
UR_D	-0.0041	0.0177	-0.232
Year	0.0035*	0.0014	2.484
East	0.0714*	0.0268	2.663
West	0.3300**	0.0296	11.142
North	0.2942**	0.0331	8.886
South	0.7287**	0.0269	27.067
Adjusted R^2	0.8564		

** Shows significance at 1% level; * Shows significance at 5% level
Dependent variable: Ln (Per capita quantity consumed of spices)
Explanatory variables:
ln (SP_P) = ln (Price of spices/Stone food price index)
ln (EXP_F1) = ln (Per capita food expenditure/ Stone food price index)
ln (EXP_F2) = ln (EXP_F1) x ln (EXP_F1)
F_size = Family size; UR_D = Urban dummy (Urban = 1, otherwise = 0);
Year = Year: 1987, 1999
East = Dummy for the eastern states of India
West = Dummy for the western states of India
North = Dummy for the northern states of India
South = Dummy for the southern states of India

these regions. The own price elasticity was obtained directly from the spices consumption function and was observed to be –0.66. This provided quite a logical conclusion that an increase in the prices of spices would lead to reduction in their consumption.

Expenditure Elasticities

The expenditure elasticities for spices in 1987 and 1999 by income classes and across different regions in India were computed from the estimated models. Separate figures were obtained for the rural and urban households and are presented in the Tables 3 and 4, respectively. All the estimated elasticity coefficients were less than one and ranged between 0.37 and 0.61. The inelastic nature of estimated elasticities implied that people in India gave considerable importance to spices in their diet. A thorough perusal of these tables revealed that there was a little change in the values of the

expenditure elasticity of spices over time. This implies that the importance of spices in the consumers' food basket had not changed much between the years 1987 and 1999. In both the rural and urban households, higher values of elasticities were seen for low-income groups than higher income groups. For the very poor income class, the elasticity ranged from 0.57 to 0.60 in various regions, whereas it ranged between 0.37 and 0.44 for the non-poor high income class.

A comparison of expenditure elasticities of spices across different regions in India, namely, Eastern, Western, Northern and Southern, from the Tables 3 and 4, helped in concluding that the elasticity figures showed little disparity across different regions. In the year 1999, the elasticities obtained for all the regions ranged between 0.51 and 0.54. This underlined that consumers across different regions in the country gave equal importance to spices in their expenditure pattern, though the quantity of consumption could vary widely across different regions.

The all-India expenditure elasticity for rural households in the year 1999 was 0.53 while it was 0.51 for the urban households in the same year. This indicated that there was no considerable difference between the rural and urban households in respect of preference for spices.

The demand analysis, in general, revealed that spices occupy an important status in the Indian diet which has remained more or less unchanged over the years. Moreover, spices enjoy dominance irrespective of regions and economic status of the people in both the rural and urban households, unlike other food items.

Table 3. Expenditure elasticities of spices across regions and income classes in rural households in India for 1987 and 1999

Region	Year	Very poor	Moderately poor	Non-poor low	Non-poor high	All classes
East	1987	0.6	0.57	0.53	0.44	0.54
	1999	0.6	0.57	0.53	0.45	0.54
West	1987	0.6	0.57	0.53	0.43	0.53
	1999	0.59	0.55	0.52	0.43	0.52
North	1987	0.60	0.56	0.52	0.43	0.52
	1999	0.59	0.56	0.52	0.43	0.52
South	1987	0.61	0.57	0.53	0.41	0.54
	1999	0.60	0.57	0.52	0.43	0.53
All-India	1987	0.60	0.57	0.53	0.43	0.53
	1999	0.60	0.57	0.53	0.44	0.53

Table 4. Expenditure elasticities of spices across regions and income classes in urban households in India for 1987 and 1999

Region	Year	Very poor	Moderately poor	Non-poor low	Non-poor high	All classes
East	1987	0.59	0.55	0.51	0.39	0.51
	1999	0.59	0.56	0.51	0.40	0.51
West	1987	0.57	0.53	0.49	0.37	0.49
	1999	0.58	0.54	0.50	0.40	0.50
North	1987	0.58	0.54	0.50	0.37	0.50
	1999	0.58	0.55	0.51	0.38	0.51
South	1987	0.58	0.54	0.50	0.39	0.51
	1999	0.59	0.55	0.51	0.41	0.51
All-India	1987	0.58	0.54	0.50	0.39	0.50
	1999	0.59	0.55	0.51	0.40	0.51

Very poor (below 75% of the poverty line); Moderately poor (from 75% below the poverty line to the poverty line); Non-poor low (from the poverty line to 150% above the poverty line) and Non-poor high (above 150% of the poverty line).

Demand Projections

The household consumption demand was projected for the years 2005, 2010 and 2015 for major spices in India by assuming 1999 as the base year (Table 5). The projections were carried out based on the price and expenditure elasticities of spices. The projected rural and urban population and the average price and income growth rates for the years 2005, 2010 and 2015 were employed for the demand projections.

The projected estimates for household consumption demand for total spices are 3.34 million tonnes, 3.62 million tonnes and 3.90 million tonnes for the years 2005, 2010 and 2015, respectively, given the base year consumption demand of 3.02 million tonnes. The analysis revealed a steady increase in demand for spices in India in the coming years. For chillies, the projected demand stood at 0.89 million tonnes by the year 2015 from the current (1999) level of 0.89 million tonnes. All the major spices in India exhibited a similar upward trend in the coming years. Consumption demand for ginger was estimated to rise from 0.28 million tonnes in 1999 to 0.37 million tonnes by 2015. The demand for turmeric will jump from 0.43 million tonnes in 1999 to 0.55 million tonnes by 2015, while demand for black pepper was projected to increase from 0.04 million tonnes in the base year to 0.06 million tonnes by 2015. Garlic demand was estimated to rise from 0.49 million tonnes to 0.64 million tonnes over these years.

Table 5. Projected household consumption demand for spices in India: 2005-2015
(million tonnes)

Commodity	Projected household demand			
	1999	2005	2010	2015
Chilli	0.69	0.77	0.83	0.89
Ginger	0.28	0.32	0.34	0.37
Turmeric	0.43	0.48	0.52	0.55
Black pepper	0.04	0.04	0.05	0.06
Garlic	0.49	0.54	0.59	0.64
All spices	3.02	3.34	3.62	3.90

Conclusions

The expenditure elasticities of spices in India have been found positive and inelastic during the period (1987-88 to 1999-00) under study. The values of elasticities have not changed significantly over the years. The expenditure elasticities have been observed to be comparatively higher for lower income classes, suggesting that a positive income change would motivate consumers in that class to spend more on spices in comparison to their higher income counterparts. The elasticity estimates have been found to be almost similar for both the rural and urban households and across different regions of the country, indicating the universal importance of spices in the consumption basket in India. In nutshell, the demand projections have shown that the household consumption demand for spices is on the increase in the coming years and hence the sector needs a greater attention in all respects.

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