Agric. Econ. Res. Rev., Vol. 8(2), pp. 7-17 (1995)

DEMAND FOR FRUITS AND VEGETABLES IN INDIA

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India is a vast country, endowed with diverse agro-climatic conditions that are conducive to grow large array of horticultural crops. India produces about 30 million tonnes (mt) of fruits and over 70 mt of vegetables and ranks second in the production of fruits after Brazil, accounting for nearly 8 percent of the world production of fruits. In the production of vegetables, India is next to China with about 13 percent of the world production. Urbanization, changes in lifestyle, growth in economy as well as sizeable additions to population have increased domestic demand for horticultural products. Recent trade liberalization and substantial increases in investments for horticulture (from rupees two hundred forty million in the Seventh Plan to rupees ten thousand million in the Eighth Plan) have opened up the prospects for exports as well as the processing industry of fruits and vegetables in the country. This emerging scenario will change the supply and demand prospects for fruits and vegetables in the next century which will occupy an important place in the dietary pattern. This paper examines the consumption pattern of fruits and vegetables and projects the demand for fruits and vegetables in the year 2020. The paper also examines the export prospects of major fruits and vegetables from India and suggests the polices to meet the requirements.

Data and Analytical Procedure

The data

The study used data of National Sample Survey (NSS) rounds number 32 and 43 pertaining to the years 1977/78 and 1987/88. These rounds provide disaggregate data on consumption in terms of quantity and value for major commodities by 12/14 expenditure groups, by urban-rural locations and also by states. Retail prices of commodities, for which the quantities were not available, are compiled from Agricultural Prices in India published by the Directorate of Economics and Statistics (DE&S), Government of India. The average retail monthly prices of commodities

of each state were averaged for the corresponding months of the NSS rounds. The quantities consumed were computed implicitly as expenditure divided by the prices for each of the expenditure classes in each round. The expenditure strata, four for the rural and four for the urban, are formed on the basis of the poverty lines adopted by the Planning Commission (Radhakrishna and Ravi, 1990). Based on the expenditure classes of NSS persons below 75 percent of the poverty line are defined as very poor, between 75 percent and poverty line as moderately poor, between poverty line and 150 percent of the poverty line as non-poor lower and expenditure classes above 150 percent of poverty line as non-poor higher. Per capita expenditure is taken as a proxy to income and these terms are used interchangeably in the paper. In addition to urbanization and economic status, consumption pattern is also influenced by region. Demand parameter estimates may vary by region, urbanization and income group. The state wise data were aggregated into four regions namely Eastern region covering the states of Assam, Bihar, Orissa and West-Bengal; Northern region which includes Haryana, Punjab, Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir; Western region covering Gujarat, Maharashtra, Madhya Pradesh and Rajasthan; and southern region covering Andhra Pradesh, Tamil Nadu, Karnataka and Kerala. The data on production of fruits and vegetables are compiled from various Publications of the DE&S, and National Horticulture Board, Ministry of Agriculture, Government of India. The data on export by commodities are compiled for the period 1980-81 to 1993-94 from the publications of the Directorate General of Commercial Intelligence and Statistics (DGCIS), Calcutta and Agricultural and Processed Food Products Export Development Authority (APEDA).

Demand projections

The demand projections for commodities are done by using the following formula:

(1) $D_{ijkt} = d_{ijk0} * N_{ijkt} (1+y*e_{ijk})^t$

$$D_t = \sum\sum\sum D_{ijkt}$$

where D_{ijkt} is demand for a commodity for the sub group of 'i' th lifestyle (rural, urban), 'j'th region (eastern, western, northern, southern regions of India), 'k' th income group (very poor, moderately poor, non-poor lower and non-poor high) and in 't'th period; d_{ijk0} is per capita consumption demand for 'i' th lifestyle, 'j'th region, 'k' th income group in the base year (1987-88); N_{ijkt} is population in 't'th year belonging to 'i' th lifestyle, 'j' th region, 'k' th income group, y is growth in per capita expenditure (income) and e_{ijk} is the expenditure elasticities for the sub group population belonging to 'i' th lifestyle, 'j'th region, 'k' th income group. D_t is aggregate demand in year t which is the sum over i,j,k for D_{ijkt}. D_t capture the income and population distribution effects on demand which is taking place across income groups within region and across regions within the rural/urban groups. Thus it take into account the structural changes. In the absence of these effects, the demand of the commodity can be predicted by using the simple following formulation:

$$(2) \qquad D_{*t} = d_0 \; {}^*N_t \; (1+y^*e)^t$$

where, D_t is household demand of a commodity in year t; d_o is per capita demand of the commodity in the base year, y is growth in per capita income; e is the expenditure elasticity of demand for the commodity; N_t is the projected population in year t. The formulation given in (2) is most common in demand studies as it requires less information and parameters at the aggregate level. This formulation does not capture the distributional effects of income and population. These effects can be substantial if the consumption behaviour across income groups is skewed and population moves from low income to high income bracket with the process of economic growth. Thus, the demand projections are done for each sub group using the formulation given in (1) and then aggregated to arrive at the national figures of demand for fruits and vegetables for the years 2000, 2010, and 2020.

Results and Discussion

Consumption of fruits and vegetables

Per capita aggregate cereal consumption for food has declined some what over the past three decades, while fruits, vegetables, meat, fish, eggs and dairy consumption have increased. Urban areas exhibited a more diversified food basket with significantly higher levels of per capita consumption of milk and milk products, fruits and vegetables. Increasing urbanization and widening rural-urban disparity have reduced the demand per head for cereals and increased the demand for fruits, vegetables and milk at a faster rate.

During the decade, per capita annual consumption of fruits and vegetables increased from 27 Kg to 61 Kg in rural areas and 46 Kg to 95 Kg in urban areas (Table 1). However, the per capita consumption of fruits and vegetables is still low as compared to the recommended levels. Consumption of fruits increased with increase in income in all the regions, both in rural and urban India.

Among the regions, Southern region excelled in change in per capita consumption of fruits by income classes (particularly in the upper most income strata) both in rural and urban India. Eastern region is however on the lower end of the continuum (Appendix 1). In respect of consumption of vegetables, Eastern region sprang a welcome surprise by being on the top. Southern region is now at the bottom (Appendix 2).

As seen in Table 2, the population distribution by income classes is highly skewed in urban India and so is the consumption of fruits and vegetables, particularly fruits. Three fourth of India's population living in rural areas consumed 57 percent of total fruits and 68 percent of the total vegetables. One fourth urban population shared 43 percent of fruits and 32 percent of vegetables.

Demand elasticity

The food characteristic demand system developed by Bouis (1992), which is based on demand for energy, variety, and taste of foods is used to derive the demand elasticities (Table 3). The expenditure elasticity of demand for fruits is higher than vegetables; it is higher in lower income classes than higher ones, both in rural and urban India. Regional variation in the magnitude of demand elasticities are observed. For vegetables, it ranged between 0.27 to 0.54 being low in Northern region and high in Southern region. However, fruits elasticities of demand did not vary significantly across the regions. For India, the average demand elasticity is estimated to be 0.41 for fruits and 0.34 for vegetables.

Demand for fruits and vegetables

The demand elasticities given in Table 3 are used for projecting the demand for fruits and vegetables under the assumptions that: (i) total

Table 1 :Change in annual per capita consumption of fruits vegetables in India

(Kilograms)

Income Group	Rural			Urban		
	1977	1987	Change	1977	1987	Change
			Fruits			
ALL	2.6	10.3	7.7	5.9	18.8	12.9
I	1.0	3.0	2.0	1.4	5.0	3.6
II	1.4	5.2	3.8	2.1	9.0	6.9
III	3.0	8.7	5.7	3.9	14.9	11.0
IV	8.2	20.5	12.3	11.7	35.8	24.1
			Vegetables			
All	24.7	50.8	26.1	39.5	66.4	26.9
I	15.8	33.3	17.5	18.7	35.4	16.7
II	23.3	41.4	18.1	26.6	48.2	21.6
III	29.5	50.4	20.9	35.7	65.3	29.6
IV	42.6	70.0	27.4	60.2	94.3	34.1

I: Very poor; II: Moderately poor;
III: Non-poor lower; IV : Non-poor higher.

Table 2 : Distribution pattern of fruits and vegetables in 1987-88, India

Income group	Share in population (%)	Share in consumption	
		Fruits	Vegetables
Rural	75.5	56.7	67.8
I	27.0	8.8	18.5
II	20.5	11.6	17.5
III	28.7	27.1	29.8
IV	23.8	52.5	34.2
Urban	24.5	43.3	32.2
I	15.1	3.7	7.5
II	14.4	5.9	9.8
III	26.6	18.3	24.6
IV	43.9	72.1	58.1
India	100.0	100.0	100.0
I	24.1	6.5	15.0
II	19.0	9.2	15.0
III	28.3	23.3	28,1
IV	28.6	61.0	41.9

I: Very poor; II: Moderately poor;
III: Non-poor lower; IV: Non-poor higher.

income grows at 4 or 5 or 7 percent per annum; (ii) population grows at 2.0 percent per annum during 1991 to 1995, 1.9 percent during 1995 to 2000, 1.8 percent during the period 2000 to 2010, and 1.7 percent during the period 2010 to 2020; and (iii) pace of urbanization will be consistent with the recent historical trend. Apart from the household consumption, there are heavy post-harvest losses at different stages. The share of household consumption in total production is estimated at 83.5 percent for vegetables and 41.2 percent for fruits. This difference not only includes the post-harvest losses but also includes the industrial uses (processing, etc.) and exports. In the absence of post harvest losses of commodities and also other uses which are not included in the NSS consumer survey, the average production figures for the year 1991 is taken as the base year demand while making the projections of total requirements in the years 2000 and 2020. The demand for fruits and vegetables have been predicted at constant prices.

Demand predictions with and without structural change at 5 percent GDP growth are shown in Table 4. The results revealed that the demand for fruits and vegetables will be grossly underestimated if the predictions are done with out taking into account the effects of structural changes which are caused as a result of regional variations in consumption pattern, urbanisation, and changes in income distribution.

Demand predictions for fruits and vegetables under various income growth scenarios are given in Table 5. In the year 2000, demand for fruits works out to about 40-44 mt, and vegetables 82-90 mt. In the year 2020, demand will grow to about 97 mt for fruits, and 181 mt for vegetables. In the short run (1995-2000), the total demand will grow at

Table 3 : Expenditure Elasticity of Demand for Fruits and Vegetables

Income group	Eastern	Western	Northern	Southern	India
			Fruits		
Rural	0.489	0.473	0.443	0.415	0.442
I	0.940	0.850	0.730	0.790	0.801
II	0.760	0.670	0.600	0.630	0.661
III	0.580	0.540	0.500	0.480	0.524
IV	0.310	0.300	0.310	0.250	0.293
Urban	0.384	0.378	0.361	0.343	0.360
I	0.810	0.810	0.780	0.740	0.785
II	0.710	0.610	0.600	0.560	0.610
III	0.560	0.530	0.490	0.430	0.499
IV	0.310	0.300	0.290	0.270	0.293
			Vegetables		
Rural	0.385	0.463	0.267	0.540	0.385
I	0.760	0.820	0.530	0.870	0.745
II	0.550	0.630	0.390	0.700	0.568
III	0.360	0.470	0.250	0.550	0.408
IV	0.150	0.220	0.100	0.300	0.193
Urban	0.235	0.306	0.170	0.359	0.253
I	0.640	0.740	0.490	0.840	0.669
II	0.440	0.530	0.360	0.620	0.487
III	0.290	0.380	0.220	0.470	0.338
IV	0.110	0.180	0.080	0.230	0.152

I: Very poor, II: Moderately poor,
III: Non-poor lower, IV: Non-poor high

Table 4 : Demand of fruits and vegetables at 5 per cent GDP with and without structural changes in population and income distribution

Year	Fruits		Vegetables	
	With structural change	With out structural change	With structural change	With out structural change
	(Million Tonnes)			
Base year (1991)	30.8	30.8	64.8	64.8
1995	35.0	33.4	73.0	69.4
2000	41.1	36.9	84.8	75.5
2010	56.3	45.7	112.7	89.6
2020	77.0	56.3	149.7	106.3

Table 5 : Demand for fruits and vegetables in million tonnes, India

Year	Fruits			Vegetables		
	S1	S2	S3	S1	S2	S3
1991	30.8	30.8	30.8	64.8	64.8	64.8
1995	34.5	35.0	36.2	72.0	73.0	74.9
2000	39.6	41.1	44.3	82.1	84.5	89.7
2010	52.1	56.3	65.8	105.8	112.7	127.7
2020	68.3	77.0	97.6	136.0	149.7	181.1

S1: 4% gross domestic product (GDP), S2: 5% GDP and S3: 7% GDP

the annual compound growth rate of 2.8-4.1 percent for fruits, and 2.6-3.6 percent for vegetables.

Conclusions

The growth rate in output achieved during 1980-90 was (4.7 percent for fruits, and 3.4 percent for vegetables) higher at the margin than the demand growth of these commodities. Per capita availability of arable land in India is quite low and declining over time. Diversification towards fruits and vegetables can provide adequate income and employment to the farmers, particularly to small farmers.

References

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Appendix 1 : Changes in Consumption of Fruits (Kg), India

Region Income Group	Rural			Urban		
	1977	1987	Change	1977	1987	Change
Eastern	1.2	5.0	3.8	3.5	10.2	6.7
I	0.4	1.7	1.3	0.4	2.6	2.2
II	0.8	2.6	1.8	0.8	3.6	2.8
III	1.5	4.9	3.4	2.1	8.4	6.3
IV	7.0	11.7	4.7	8.6	22.1	13.5
Western	1.9	8.5	6.6	5.7	20.1	14.4
I	0.8	3.1	2.3	1.0	4.2	3.2
II	0.7	5.1	4.4	1.8	8.4	6.6
III	2.6	8.2	5.6	3.6	14.2	10.6
IV	5.7	16.1	10.4	12.1	36.7	24.6
Northern	2.1	6.4	4.3	6.3	12.1	5.8
I	0.6	2.2	1.6	0.9	3.0	2.1
II	1.0	3.4	2.4	1.8	6.1	4.3
III	1.9	4.9	3.0	3.6	10.0	6.4
IV	5.5	10.7	5.2	10.6	22.9	12.3
Southern	5.7	24.7	19.0	7.6	29.1	21.5
I	2.2	5.5	3.3	2.6	8.8	6.2
II	3.7	12.0	8.3	3.8	16.0	12.2
III	6.6	20.9	14.3	6.1	24.6	18.5
IV	15.9	47.9	32.0	16.5	55.5	39.0

Appendix 2 : Changes in Consumption of Vegetables (Kg), India

Region Income Group	Rural			Urban		
	1977	1987	Change	1977	1987	Change
Eastern	30.5	63.8	33.3	50.7	94.0	43.3
I	20.3	39.6	19.3	26.1	61.6	35.5
II	30.4	52.5	22.1	36.0	72.2	36.2
III	39.5	66.7	27.2	49.1	92.2	43.1
IV	65.7	98.7	33.0	77.2	133.1	55.9
Western	18.1	37.3	19.2	32.9	64.1	31.2
I	11.4	22.1	10.7	15.0	27.6	12.6
II	17.3	30.9	13.6	21.8	44.8	23.0
III	22.5	38.2	15.7	30.0	60.7	30.7
IV	33.6	54.2	20.6	50.4	89.1	38.7
Northern	30.8	66.8	36.0	51.0	83.0	32.0
I	20.9	55.8	34.9	25.6	46.6	21.0
II	26.3	53.5	27.2	33.2	60.1	26.9
III	32.1	60.7	28.6	42.2	84.3	42.1
IV	45.7	82.4	36.7	68.2	115.4	47.2
Southern	18.0	28.8	10.8	25.4	35.8	10.4
I	11.1	17.3	6.2	12.1	16.4	4.3
II	16.3	22.1	5.8	18.0	24.1	6.1
III	21.1	26.9	5.8	25.1	35.1	10.1
IV	33.9	41.8	7.9	42.6	56.6	14.0

Appendix 3 : Projections of population (million) by expenditure groups

Year	Very poor	Moderately poor	Non-poor lower	Non-poor higher	All Groups
			Rural		
1987	158.3	120.3	168.3	138.6	585.5
	(0.27)	(0.21)	(0.29)	(0.24)	
1991	146.8	122.4	184.7	173.4	627.3
	(0.23)	(0.20)	(0.29)	(0.28)	
1995	132.5	124.0	202.0	211.9	670.4
	(0.20)	(0.18)	(0.30)	(0.32)	
2000	113.3	121.1	218.9	272.3	725.6
	(0.16)	(0.17)	(0.30)	(0.37)	
			Urban		
1987	28.70	27.4	50.8	83.1	190.0
	(0.15)	(0.14)	(0.26)	(0.49)	
1991	26.8	27.9	55.7	106.7	217.0
	(0.12)	(0.13)	(0.26)	(0.49)	
1995	23.3	27.4	59.8	132.9	243.4
	(0.10)	(0.11)	(0.24)	(0.55)	
2000	18.9	25.5	62.0	172.4	278.8
	(0.07)	(0.09)	(0.22)	(0.62)	

Figures in parenthesis are the share of total population.
Source: Radhakrishna and Ravi (1990).