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ARTICLES

Unravelling Food Basket of Indian Households: Revisiting Underlying Changes and Future Food Demand

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ABSTRACT

The study empirically revealed striking difference in the consumption pattern of Indian households across rural and urban sectors, geographical regions and income categories. The findings were in conformity with Engel's law and Bennett's law of consumption. Expenditure elasticities of food commodities were estimated using LA-AIDS demand system and food demand was projected for the year 2020. The expenditure elasticities of high value agricultural commodities (HVACs) like milk, non-vegetarian products, fruits, etc. were higher than staple food, i.e., cereals. Further, wide inter-regional variations in the household demand for food commodities necessitates to match the demand and supply at disaggregate level and to remove the bottlenecks in production of food commodities in the respective region to fulfil the demand.

Keywords: Consumption pattern, Food commodities, Expenditure elasticities, Future household demand.

JEL: Q11, Q18, C42.

I

INTRODUCTION

In the last few decades, Indian economy has undergone a significant structural change leading to increased employment opportunities, steady growth in income, improved access to quality food, increasing urbanisation, etc. The immediate impact of these changes falls on the demand and the composition of food basket, particularly for the households who are at the bottom of the pyramid. Several scholars have studied the increasing diversification of food basket and changing dietary pattern of the consumers (Kumar and Mathur, 1996; Paroda and Kumar, 1999; Dastagiri, 2004; Keyzer *et al.,* 2005; Mittal, 2006). In the developing country like India, increasing income and its impact on food consumption needs a special mention, where a major portion (more than 50 per cent) of income is spent on food products.

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The Indian economy has grown by about 7 per cent per annum during 1990-91 and 2009-10. However, the growth has remained uneven across different sectors of the economy. The agriculture and allied sectors, which provides employment to 52 per cent of the workforce and contributes 14.2 per cent of gross domestic product (GDP at 2004-05 prices), could grow only by 2.7 per cent per annum during the same period. Sluggish growth in agriculture and allied sectors has aggravated the disparity in the income and thus consumption pattern of rural and urban households in the country. The Report on the *Status of Food Insecurity in Rural India* (MSSRF, 2008) indicates that in 2004-05, about 13 per cent of the rural population in India consumed less than 1,890 Kcal per consumer unit per day. In the hindsight of skewed income distribution, the consumption pattern and therefore nutritional status vary widely across income categories. Besides, the food habits of the Indian households also differs across different regions because of large cultural diversity and consequent differences in food histories across different regions of the country (Minhas, 1991).

It is thus pertinent to unravel the trend and pattern in food consumption of Indian households across different income classes, geographical regions and rural and urban sectors to provide in lucid manner a baseline for formulating suitable food and nutritional security policies. The present study also unwinds the expenditure elasticities of food products in different geographical regions with a purpose to estimate future food demand. This would also help in giving directions for the food industry, a sunrise sector to reorient their strategies to meet the future demands.

II

DATA AND METHODOLOGY

The consumption pattern of food commodities was studied using unit level National Sample Survey Organisation (NSSO) data on consumption expenditure pertaining to the years 1987-88 and 2004-05. The quantity consumed and expenditure on individual commodity were aggregated into food groups, i.e., cereals, pulses, edible oils, milk and milk products (MMP), non-vegetarian products, vegetables and fruits, and consumption pattern (in terms of per capita consumption and budget share) of each food group was examined across different income categories, geographical regions and rural and urban sectors. The commodities, not expressed in 'kg' unit, were converted using suitable conversion factors[1] and aggregated thereafter. Aggregation of individual food commodities in the respective food group is useful even with the usual limitations of adding foods in quantity terms.

Regional Demarcation

The regional variations in food consumption was examined by dividing India into five geographical regions, viz., North (Uttar Pradesh, Punjab, Haryana, Delhi, Chandigarh, Himachal Pradesh, Uttarakhand and Jammu and Kashmir), West

(Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Goa, Dadra and Nagar Havelli and Daman and Diu), South (Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Puducherry, Lakshadweep and Andaman and Nicobar Islands), East (West Bengal, Bihar, Odisha, Jharkhand and Chhattisgarh) and North-East (Assam, Arunachal Pradesh, Manipur, Nagaland, Sikkim, Meghalaya, Mizoram, and Tripura). It is to be noted that in the year 1987-88, Chhattisgarh was not separated from Madhya Pradesh. As Chhattisgarh is geographically close to the Eastern region with contiguous borders with Odisha and Jharkhand, district level data was extracted instead of using state level data for the year 1987-88 and aggregated to form the respective regions.

Income Categories

Income category-wise food consumption pattern was examined by dividing households into four expenditure classes[2] based on poverty line. The households were classified as, *very poor* with consumption expenditure of less than 75 per cent of poverty line, *poor* with consumption expenditure below poverty line up to 75 per cent of poverty line, *middle class* with consumption expenditure ranging from poverty line up to 150 per cent of poverty line and *rich* with consumption expenditure more than 150 per cent of poverty line (Radhakrishna and Ravi, 1990, Kumar *et al.,* 2011). Monthly per capita consumption expenditure at poverty line was taken as Rs. 356 for rural areas and Rs.538 for urban areas (Government of India, 2007). To compare the results pertaining to the years 1987-88 and 2004-05, all the expenditure values were expressed at 2008 prices by using consumer price index (CPI) for agricultural labour for the rural sector and CPI for Urban Non- Manual Employees for the urban sector.

Divisia Indices for Temporal Consumption Changes

Temporal change in consumption of food commodities between 1987-88 and 2004-05 was studied by estimating Divisia Quantity Index (DQ). DQ is a combined measure of change in consumption of all the food groups together (Selvanathan and Selvanathan, 2006). DQ was estimated as follows:

$$DQ = \sum_{i=1}^{n} \overline{w}_i \, (\ln Q_{it} - \ln Q_{it-1}) \qquad \ldots.(1)$$

where,

Q_{it} = per capita consumption (kg) of i-th commodity in period t (2004-05),

Q_{it-1} = per capita consumption (kg) of i-th commodity in period t-1 (1987-88),

$\overline{w}_i$ = arithmetic mean of budget share of i-th commodity in period t and t-1, and

n = food groups, i.e., cereals, pulses, edible oils, MMP, non-vegetarian products.

It is to be noted that DQ represents change in quantity of all defined food groups together during the periods under consideration. As within the food basket, the consumption pattern of all the food commodities do not follow similar trend, relative quantity log-changes were calculated to know the change in consumption of individual food groups (cereals, pulses, edible oils, MMP, non-vegetarian products, vegetables and fruits) relative to overall food consumption change (DQ). This will also provide an idea about the changing importance of food commodities within food basket during the period under consideration.

$$RQLC_i = DQ_1 - DQ \quad \text{....(2)}$$

where,

$RQLC_i$ = relative quantity log change of i-th food group, and

$DQ_i = \ln Q_{it} - \ln Q_{it-1}$

Similarly, Divisia Price Index (DP) was also estimated to know the changing structure of prices of food commodities during the period under consideration.

$$DP = \sum_{i=1}^{n} \overline{w}_i (1n\, P_{it} - 1n\, P_{it-1}) \quad \text{....(3)}$$

where

P_{it} = unit price of i-th food commodity in period t (2004-05), and

P_{it-1} = unit price of i-th food commodity in period t-1 (1987-88)

Unit price of each food group is the ratio of expenditure to the quantity consumed of the respective food commodity group. DP was estimated in nominal as well as real (at 2008 prices) terms. Further, attempts were made to know the co-movement of real price and quantity of food commodities by estimating divisia price-quantity correlation coefficient (p_t) as follows:

$$\rho_t = \frac{\sum_{i=1}^{n} \overline{w}_i (DP_i - DP)(DQ_i - DQ)}{\sqrt{\left[\sum_{i=1}^{n} \overline{w}_i (DQ_i - DQ)^2\right]\left[\sum_{i=1}^{n} \overline{w}_i (DP_i - DP)^2\right]}} \quad \text{....(4)}$$

Expenditure Elasticity using LA-AIDS Model

Expenditure elasticity explains the likely responsiveness of income on the consumption of food commodities and is used to project their future demand. Expenditure elasticity of food commodities were estimated separately for each region

and rural and urban sectors separately using cross sectional data pertaining to the year 2004-05. The study used multi-stage (two stage) budgeting framework with Almost Ideal Demand System using Linear Approximation (LA-AIDS) developed by Deaton and Muellbauer (1980) to model the consumption behaviour of the households. The multistage budgeting technique addresses a common problem in empirical estimation of system demand models requiring a sizeable number of equations, given the wide-variety of consumption goods jointly purchased by the households (Mustapha *et al.*, 1994; Tiffin and Tiffin, 1999).

In the first stage, the expenditure elasticity of food was estimated with ordinary least squares (OLS) procedure using the following linear function:

$$\ln F = \alpha + \beta \ln p_f + \gamma \ln y + \delta_1 z_1 + \delta_2 z_2 + \delta_3 z_3 + e \quad \ldots. (5)$$

where,

F = monthly per capita food expenditure,
γ = monthly per capita total expenditure,
p_f = unit price of food,
z_1 = age of household head
z_2 = household size, and
z_3 = child proportion

In the second stage, a household allocates a portion of food expenditure for the consumption of food groups such as cereals, pulses, edible oils, MMP, vegetables, non-vegetarian products, etc. The natural approach would be to include purchase of food in the right hand side as regressor. This raises the second major problem, which is simultaneity, given that such purchasing decisions are endogenous. To address this, the predicted value rather than actual value is used as regressor (Tiffin and Tiffin, 1999; Dey, 2000). Another problem arises that several commodities have a consumption value of zero for several households due to variation in the preference, infrequent purchasing and/or misreporting (Keen, 1986). To overcome the problem of zero observations, two-step Heckman estimation procedure was used, wherein, first a probit regression model is computed in order to estimate the probability that a given household consumes the given commodity (Heien and Wessells, 1990). This regression is used to estimate the inverse mills ratio (IMR) for each household, which is used as an instrument in the second regression. The structural form of LA-AIDS, which was employed in the second stage of demand system is as follows:

$$s_i = a_i + \sum_{j=1}^{n} b_{ij} \ln p_{ij} + c_i \ln\left(\frac{\hat{F}}{I}\right) + d_i IMR_i + \delta_{1i} z_{1i} + \delta_{2i} z_{2i} + ei \quad \ldots. (6)$$

where,

s_i = budget share of i-th commodity in food expenditure, i = 1, 2, 3, …..n

p_{ij} = price of j-th food group in i-th food equation,
I = stone price index of the respective commodity (eqn. 10),
$\hat{F}$ = predicted value of food expenditure from eqn (8),
IMR_i = inverse mills ratio with respect to i-th food commodity,
z_{1i} = age of household head, and
z_{2i} = household size

$$\ln I = \sum_i \varpi_i \ln pi \qquad \ldots.(7)$$

where, ϖ_i is the mean of the expenditure share of the i-th commodity. Further, it is to be noted that although simultaneity bias has been reported in the estimation using LA-AIDS, this model is widely used because it is relatively easy to estimate and interpret, satisfies axioms of choices exactly, compatible with aggregation over consumers and consistent with household budget data (Deaton and Meulbauer, 1980; Alston and Chalfant, 1993; Eales and Unnevehr, 1988). To be consistent with microeconomic theory (consumer is a utility maximiser), certain restrictions were imposed: (1) homogeneity of degree zero in prices and income (i.e., consumers have no money illusion); (2) symmetrical cross elasticities, and; (3) additivity (all the budget shares add up to 1). Since the errors of this system of equations tend to be correlated as the samples drawn were almost identical, seemingly unrelated regression estimation (SURE) model, proposed by Zellner (1962), was used to get the efficient estimators of the model. The SURE model employs feasible generalised least squares technique for estimating the model.

The expenditure elasticity for i-th food commodity with respect to total food expenditure was estimated by:

$$n_i = 1 + \frac{C_i}{\varpi_i} \qquad \ldots.(8)$$

Finally, the expenditure (income) elasticity of i-th food commodity was calculated as a product of commodity group elasticity with respect to food expenditure (from eqn 9) and food expenditure elasticity with respect to total consumption expenditure (from eqn 8).

Food Demand Projection

The demand for the food commodities was projected for the year 2020 for each region and both the sectors separately using the following expression;

$$D_t = d_0 * N_t (1 + y * e)^t \qquad \ldots. (9)$$

where,

D_t = household demand of a commodity in year t,
d_0 = per capita demand of the commodities in the base year,
y = growth in per capita income,
e = expenditure elasticity of demand for the commodity, and
N_t = projected population in year t.

To make demand projections for the consumption of food commodities, in the simulation, two alternate scenarios of the income growth rate were used. First scenario, i.e., Business as Usual (BAU) was built by estimating the growth rate in gross domestic product at 1999-2000 prices from the year 2003-04 to 2007-08 for different regions of the country. Alternatively, high growth rate (9 per cent per annum) in income scenario was used. Growth rates in per capita income under alternative scenarios were worked out by subtracting the population growth from income growth. The projected population estimates were taken from the Registrar General of India for the year 2020. State wise population estimates were aggregated to represent population of the respective regions (Appendix 1).

III

RESULTS AND DISCUSSION

Income Category-wise Food Consumption Pattern in India

The consumption pattern of food commodities depends to a large extent on income of the household. The share of food expenditure in total income was found to be inversely related to the household income (Table 1). Very-poor households spent 65.95 per cent of their income (MPCE) on food as compared to 42.39 per cent by the rich households in India in 2004-05. This trend was consistent in both rural as well as urban sectors. Notwithstanding the proportion of MPCE spent on food was comparatively higher for rural households than their urban counterparts in all the income categories. The inverse relationship between income and food budget (share) was in conformity with the Engel's law which states that as income increases, the proportion of income on food items decreases, though the actual expenditure may increase.

TABLE 1. EXPENDITURE PATTERN ACROSS DIFFERENT INCOME CLASSES IN INDIA

Income class	Share of food in MPCE in 2004-05			Change between 1987-88 and 2009-10		
	Rural	Urban	Combine	Rural	Urban	Combine
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very-poor	67.53	63.16	65.95	-5.82	-7.97	-6.68
Poor	65.37	58.79	63.55	-6.93	-8.78	-7.47
Middle	62.22	53.29	59.85	-6.78	-9.91	-7.62
Rich	47.68	35.71	42.39	-7.94	-11.73	-10.24
All classes	54.36	41.01	49.25	-8.57	-13.51	-10.95

The real (at 2008 prices) MPCE increased by 11.27 and 23.77 per cent in rural and urban sectors between 1987-88 and 2004-05, respectively. Consequently, the share of food in total MPCE declined though at varying degree (6-12 per cent) for different income categories during the same period. The decline in food share was comparatively higher for urban and rich households than the rural and poor households. Similar shift in consumption expenditure of Indian households has been reported by several authors (Kumar, 1996; Meenakshi, 1996; Rao, 2000; Radhakrishna, 2005). Thus, an improvement in income prompts consumers to diversify their consumption expenditure away from food products towards non-food items. However, the absolute consumption of food products increases with the improvement in income.

Within the food basket, there existed contrasting variation in the consumption pattern across different income categories. The per capita consumption of all food groups increased with the increase in income, but their share in total food expenditure showed mixed trend depending upon the food group (Table 2). In case of cereals, pulses, edible oils and vegetables, the expenditure share reduced with the increase in income, while for MMP, non-vegetarian products and fruits, it increased in the rural as well as urban sectors. Decreasing share of essential food commodities (cereals, pulses, edible oils and vegetables) and increasing share of high value agricultural commodities (HVACs) (MMP, non-vegetarian products and fruits) with the rise in income confirms empirically Bennett's law of consumption which states that as income increases, the consumers typically switch to a more expensive diet, substituting quality for quantity. The shift in the dietary pattern away from cereal consumption to more expensive milk, poultry and meat products is a consistent change associated with economic growth (Meenakshi, 1996). Interestingly, the

TABLE 2. INCOME GROUP WISE CONSUMPTION PATTERN OF FOOD COMMODITIES IN INDIA IN 2004-05

(*share in food expenditure*)

	Very Poor		Poor		Middle		Rich	
Food commodity	R	U	R	U	R	U	R	U
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cereals	48.74	38.62	43.19	33.14	36.22	28.59	27.21	20.76
	(124)	(116)	(138)	(122)	(146)	(122)	(154)	(118)
Pulses	6.35	6.35	6.38	6.35	6.14	6.04	5.58	5.08
	(5)	(6)	(7)	(8)	(8)	(9)	(11)	(12)
MMP	4.45	9.87	7.77	12.92	13.31	16.78	20.00	21.84
	(8)	(20)	(18)	(33)	(39)	(52)	(86)	(93)
Edible Oils	9.02	9.09	9.12	9.16	8.81	8.99	8.04	8.08
	(3)	(4)	(4)	(6)	(5)	(7)	(8)	(10)
Non-veg	3.74	5.33	4.74	6.60	5.46	6.50	7.11	6.73
	(2)	(3)	(3)	(5)	(4)	(6)	(8)	(8)
Vegetables	12.87	12.13	12.46	11.82	11.80	11.20	10.38	10.49
	(41)	(47)	(52)	(57)	(61)	(65)	(75)	(81)
Fruits	1.18	1.80	1.48	2.31	2.08	3.16	3.69	5.19
	(3)	(4)	(4)	(6)	(6)	(10)	(14)	(20)

R: Rural, U: Urban, MMP: milk and milk products.

Figures in parentheses are per capita annual consumption (kg/capita/annum) of respective food group.

growth in the consumption of HVACs with the rise in income was higher for rural households than urban counterparts. This indicates that rural households have higher propensity to consume HVACs than their urban counterparts. Thus, any income generating opportunity in the rural areas would fuel the demand for HVACs more than that in the urban areas.

Regional Variations in Food Consumption Pattern in India

A perusal of Table 3 reveals that food basket of the Indian households is predominated by cereals followed by MMP. However, the food habits of the Indian households varied across different geographical regions. The share of cereals in total food budget varied from 21.81 per cent in urban West to 42.82 per cent in rural East in 2004-05. The per capita consumption of cereals followed the similar trend. It is to be noted that the consumption of cereals was comparatively higher in the rural sector in all the regions. It might be due to easy and cheap availability as well as payment of wages in kind form (grains) for most of the labour activities in rural India.

TABLE 3. REGION-WISE CONSUMPTION PATTERN OF FOOD COMMODITIES IN INDIA IN 2004-05

(share in food expenditure)

Food	North		West		South		East		North-East		India	
group	R	U	R	U	R	U	R	U	R	U	R	U
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Cereals	29.02	22.04	28.08	21.81	31.33	27.08	42.82	29.42	37.84	30.06	33.13	24.52
	(149)	(122)	(135)	(109)	(133)	(117)	(159)	(137)	(156)	(147)	(145)	(119)
Pulses	6.52	5.48	6.21	5.54	6.15	5.91	4.97	4.74	4.69	4.26	5.90	5.47
	(10)	(10)	(9)	(10)	(9)	(10)	(7)	(8)	(7)	(8)	(9)	(10)
MMP	23.45	26.27	21.48	21.70	10.42	14.73	8.14	11.42	6.26	9.27	15.58	19.30
	(79)	(89)	(64)	(69)	(37)	(58)	(23)	(38)	(17)	(26)	(49)	(66)
Edible oils	8.01	7.71	9.99	9.98	7.94	7.32	8.28	8.37	6.99	7.04	8.47	8.43
	(6)	(8)	(7)	(9)	(6)	(7)	(5)	(7)	(5)	(7)	(6)	(8)
Non-veg	2.71	3.38	2.79	4.10	9.32	8.77	7.95	12.23	16.50	17.92	6.12	6.60
	(2)	(3)	(2)	(3)	(9)	(9)	(6)	(11)	(12)	(15)	(5)	(6)
Vegetables	10.97	11.61	10.16	10.76	9.46	8.83	13.40	12.85	14.10	13.18	11.22	10.85
	(69)	(88)	(45)	(57)	(45)	(50)	(81)	(96)	(84)	(84)	(62)	(70)
Fruits	2.23	3.85	2.47	4.52	5.32	5.33	1.70	3.15	1.54	2.77	2.78	4.31
	(8)	(13)	(7)	(13)	(15)	(18)	(6)	(11)	(7)	(10)	(8)	(14)

R: Rural, U: Urban, MMP: Milk and milk products.

Figures in parentheses are per capita annual consumption (kg/capita/annum) of respective food group.

In case of MMP, per capita consumption was the least in North-Eastern region, while it was the highest in Northern region. Conversely, the consumption of non-vegetarian products was the highest in North-Eastern region, while it was the least in Northern region. This indicated the sharp contrast in food preferences in different regions as MMP and non-vegetarian products are preferred by different groups. The regional variation in food consumption pattern might be due to diversity in cultural tradition as well as relative availability of food products in the respective region. Notwithstanding MMP is primarily produced in Northern and Western part of the country and thus becomes a major constituent of food basket. The share of commodities such as pulses, edible oils, vegetables and fruits in total food budget

ranged from 4-7 per cent, 7-10 per cent, 9-14 per cent and 2-5 per cent, respectively across different regions depending upon the relative availability at affordable prices in the respective region.

Temporal Changes in Food Consumption Pattern in India

The estimated divisia quantity index (DQ), which signifies the changes in consumption of all the food commodities together, revealed that the average food consumption increased in all the regions and both the sectors except rural North and urban West between 1987-88 and 2004-05 (Table 4). Overall, the increase in food consumption in urban India was almost double that of rural India. Among the regions, Southern region witnessed highest increase of 8.08 and 10.32 per cent in the rural and urban sectors, respectively. On the other hand, estimated divisia price index (DP) revealed that though current market price (unit value) of the entire food basket increased by more than 100 per cent in all the regions, the real price (at 2008 prices) decreased between 1987-88 and 2004-05. The decrease in real prices was more pronounced in the urban sector. The decrease in real prices might have contributed in increased consumption of food commodities during the period under consideration. However, the increase in quantity consumed was proportionately less than decrease in real prices in all the regions and both the sectors except rural South, suggesting inelastic demand for food commodities. Further, the estimated correlation coefficient between divisia price and quantity index was negative which indicates inverse relationship between prices and quantity, though with varying degree across different regions.

TABLE 4. REGION-WISE DIVISIA QUANTITY (PRICE) INDEX FOR FOOD COMMODITIES AND PRICE-QUANTITY CORRELATION COEFFICIENT

Region	Divisia price index		Divisia quantity index	Divisia price-Quantity correlation coefficient
	At 2008 price	At market price		
(1)	(2)	(3)	(4)	(5)
		Rural		
North	-4.05	111.75	-2.24	-0.80
West	-11.43	104.37	2.39	-0.67
South	-7.24	108.57	8.08	-0.59
East	-14.66	101.15	2.77	-0.16
North–East	-7.82	107.98	5.74	-0.42
India	-9.00	106.80	2.41	-0.54
		Urban		
North	-13.28	110.86	2.22	-0.83
West	-14.25	109.89	-0.84	-0.90
South	-13.60	110.55	10.32	-0.75
East	-18.25	105.89	9.86	-0.79
North–East	-16.44	107.70	8.06	-0.79
India	-14.66	109.48	5.10	-0.74

Note: Food groups include cereals, pulses, edible oil, MMP, non-veg, vegetables and fruits.
Indices were multiplied by100 to express in per cent terms.

Decomposition of DQ into components (food groups) and estimation of relative quantity log changes revealed that change in quantity consumed was not uniform across different food groups (Table 5). Within the food basket, the relative decline in consumption of cereals, pulses and fruits was accompanied by relative increase in consumption of MMP, non-vegetarian products, vegetables and edible oils. This indicates the changing importance of food products and diversification within the food basket. The consumption of the cereals and pulses reduced by 20 and 28 per cent in rural India, and by 17 and 26 per cent in urban India, respectively. The decrease in the relative quantity of cereal consumption might be because of change in taste and preferences of households away from cereals (Radhakrishna, 1996; Radhakrishna and Murty, 1999). Further, decline in cereals consumption was sharper in the rural sector due to improvements in the rural infrastructure which made other food items available in the rural areas (Rao, 2000). Dasgupta and Sirohi (2010) stressed that the foodgrains consumption has declined largely on account of reduced consumption of coarse cereals, while for superior cereals like, rice and wheat the decline is marginal. Decline in the consumption of coarse grains is due to easy access and increasing availability of rice and wheat resulting from favourable policy and technology, through exposure to high value agricultural commodities and shifts in the dietary pattern either due to a rise in income or fall in price (Chand and Kumar, 2002).

TABLE 5. RELATIVE QUANTITY-LOG CHANGES IN FOOD GROUPS BETWEEN 1987-88 AND 2004-05

Region (1)	Cereals (2)	Pulses (3)	MMP (4)	Edible oils (5)	Non-veg (6)	Vegetables (7)	Fruits (8)
				Rural			
North	-0.163	-0.318	0.048	0.392	0.061	0.217	-0.432
West	-0.251	-0.348	0.244	0.268	-0.071	0.261	-0.030
South	-0.246	-0.114	0.201	0.379	0.219	0.296	0.246
East	-0.180	-0.350	0.291	0.454	0.154	0.240	0.039
N -E	-0.172	-0.235	-0.124	0.451	0.190	0.295	-0.285
India	-0.200	-0.288	0.157	0.372	0.147	0.257	-0.058
				Urban			
North	-0.128	-0.278	0.080	0.141	-0.148	0.217	-0.644
West	-0.148	-0.288	0.109	0.122	-0.265	0.227	-0.237
South	-0.194	-0.164	0.184	0.164	0.153	0.197	0.038
East	-0.202	-0.328	0.058	0.206	0.199	0.152	-0.053
N -E	-0.142	-0.355	-0.130	0.238	0.235	0.173	-0.252
India	-0.170	-0.258	0.122	0.155	0.017	0.198	-0.247

MMP: milk and milk products.

The relative decline in per capita consumption of fruits, though not uniform across different regions, might be due to low base value or increasing preference of consumers towards processed fruit products and juices. The relative increase in the consumption of MMP, non-vegetarian products, vegetables and edible oils indicated improvement in the nutritional status of the households through increasing consumption of these commodities. However, the implications of declining

foodgrains consumption and dietary diversification towards HVACs on food and nutritional security depend on the net nutritional intake which seems to be paradoxical. Increasing consumption of HVACs should outstrip the decline in the nutritional intake due to decreasing foodgrains consumption.

Further, the increase in relative quantity of aforesaid commodities was not uniform across the regions. For example, relative quantity of MMP in the North-Eastern region and relative quantity of non-vegetarian products in the Northern (urban sector) and Western (both rural and urban sector) regions declined between 1987-88 and 2004-05. The decline in MMP consumption in North-East and non-veg consumption in Northern and Western regions might be because of less preference towards these commodities in the respective region.

Estimated Expenditure Elasticity and Demand Projection of Food Commodities

Food, being a necessary item, exhibits inelastic demand. However, within the food basket, different items respond differently with the change in income of households. The estimated expenditure elasticity of cereals was positive but lowest among the food commodities in all the regions indicating that increase in income of households will lead only a marginal increase in cereals consumption (Table 6). On the other hand, expenditure elasticity of HVACs such as MMP, non-vegetarian products and fruits was comparatively higher than others, though with inter-regional variations. Thus, HVACs are relatively income elastic and with the increase in income (expenditure), demand for these commodities will be higher than staple foods. Further, expenditure elasticity of food items was higher for rural households than urban counterparts. This indicates that food demand will be comparatively higher in rural areas with per unit rise in income. The estimated expenditure elasticities and food projections were found to be comparable with other studies (Appendix 2), though there exists wide variation in these estimations due to differences in database used, methodology adopted and assumptions made in the estimation procedure.

TABLE 6. ESTIMATED EXPENDITURE ELASTICITY OF FOOD COMMODITIES

	North		West		South		East		North-East		India	
Food group	R	U	R	U	R	U	R	U	R	U	R	U
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Cereals	0.15	0.10	0.19	0.13	0.23	0.22	0.31	0.16	0.32	0.17	0.24	0.15
Pulses	0.46	0.47	0.59	0.40	0.50	0.53	0.71	0.54	0.65	0.53	0.56	0.46
MMP	0.82	0.77	1.16	0.72	0.77	0.71	1.31	0.87	1.06	1.28	1.00	0.82
Edible oils	0.52	0.47	0.64	0.50	0.40	0.49	0.67	0.57	0.55	0.56	0.54	0.52
Non-veg	0.76	0.64	0.88	0.67	0.87	0.67	1.16	0.86	0.95	0.94	1.04	0.76
Vegetables	0.45	0.38	0.49	0.40	0.40	0.44	0.52	0.43	0.53	0.57	0.43	0.45
Fruits	1.09	1.13	1.04	1.11	1.22	0.99	1.09	1.04	0.76	1.48	1.31	1.09

R: rural, U: urban, MMP: Milk and milk products.
Estimated parameters from the model are given in Appendix 2.

Although, cereals exhibited inelastic demand, its total demand in future will be high due to increase in population and high indirect demand (seed, animal feed, industrial demand waste, etc). The total projected household demand for cereals in India was estimated to be 226-237 million tonnes (mt) in 2020 (Table 7). With the addition of indirect demand, total cereals demand will be even much higher. From the food security point of view, many studies concluded that requirements of cereals in the country will be adequately met by domestic supplies at least upto the year 2020 (Government of India, 2001) and India would be the net exporter of major cereals crops (FAPRI, 2009). There are many studies on demand-supply mismatch on food commodities with strikingly diverse conclusions for food security outlook in India (Kumar *et al.,* 1995; Bhalla *et al.*, 1999; Chand, 2007; Mittal, 2006; Amarasinghe *at al.*, 2007; FAPRI, 2009). Household demand for the HVACs such as MMP, non-vegetarian products, fruits and vegetables was projected as 179-216 mt, 17-20 mt, 40-49 mt and 136-151 mt, respectively in 2020. Further, a perusal of Table 7 reveals that there will be wide inter-regional variations in the household demand for food commodities because of varying food habits, relative availability and other socio-economic constraints. Thus, efforts should be made to match the demand and supply at disaggregate level mainly for HVACs, which is causing spiralling inflation in the recent past and improve the supply chain to even out the regional imbalance of food availability.

TABLE 7. PROJECTED HOUSEHOLD DEMAND FOR FOOD COMMODITIES IN 2020

(*million tonnes*)

Zone	Cereals	Pulses	Milk	Edible oils	Non-veg	Vegetables	Fruits
(1)	(20	(3)	(4)	(5)	(6)	(7)	(8)
			Business as usual scenario				
North	55.26	5.23	57.43	3.46	1.50	38.12	8.31
West	53.06	5.60	64.91	4.99	1.83	27.86	8.99
South	43.56	4.37	27.38	2.65	5.83	19.93	15.35
East	64.74	4.47	27.24	3.27	6.42	43.85	6.10
N –E	9.69	0.59	2.21	0.44	1.32	6.43	0.82
India	226.31	20.26	179.17	14.81	16.9	136.19	39.57
			High growth scenario				
North	57.43	5.92	71.15	3.96	1.81	42.87	11.10
West	54.70	6.12	76.97	5.52	2.09	30.12	10.74
South	45.12	4.72	30.56	2.83	6.56	21.22	18.09
East	68.57	5.10	34.35	3.71	7.90	48.46	7.49
N -E	10.90	0.76	3.39	0.55	1.90	7.96	1.21
India	236.72	22.62	216.42	16.57	20.26	150.63	48.63

IV

CONCLUSIONS AND POLICY IMPLICATIONS

Food consumption pattern of Indian households was found to be in conformity with two most important law, i.e., Engel's law and Bennett's law of consumption. The study revealed striking differences in consumption pattern across income categories, geographical regions and rural and urban sectors. These differences might

be because of a complex set of factors such as differential taste and preferences, large cultural diversity, relative affordability due to varying employment opportunities, relative availability of food commodities, etc. Further, declining share of foodgrains and simultaneous diversification of food basket over the years is a sign of consumers' welfare. However, declining per capita consumption of foodgrains needs due consideration by the policy makers from food and nutritional security point of view. Therefore, every effort should be made to improve the per capita availability, accessibility and affordability of foodgrains especially by the poor households who spend a major portion of food budget on foodgrains. The inverse relationship between food prices and consumption necessitates controlling food inflation to improve affordability of food commodities by poor households. Further, estimated expenditure elasticities confirmed that HVACs like MMP, non-vegetarian products, fruits, etc. are more responsive to increase in income than stable food with wide inter-regional variations. Although, the cereals exhibited inelastic demand, its total demand will be high due to increase in population and high indirect demand (seed, animal feed, industrial demand waste, etc.). Thus, there is a strong need to improve productivity, control prices, and strengthen public distribution system and supply chain at disaggregated level to fulfil the future food demand.

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NOTES

1. The conversion rates from numbers to kilograms used are: 1 orange= 0.125 kg, 1 green coconut = 0.25 kg, 1 banana = 0.1 kg, 1 lemon = 0.033 kg, 1 egg = 0.055 kg, 1 litre milk = 1.03kg.
2. Household expenditure is used as a proxy for household income because information on household income is rarely available.

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APPENDIX 1
POPULATION AND INCOME GROWTH SCENARIO FOR DEMAND PROJECTION

Region (1)	Sector (2)	Projected population (000) for 2020* (3)	Population growth (2004-2020) (4)	Income growth (per cent) BAU (5)	Income growth (per cent) HGS (6)
North	Rural	237468	1.33	7.25	9.00
	Urban	110328	2.54	7.25	9.00
South	Rural	218211	1.07	8.02	9.00
	Urban	134972	2.10	8.02	9.00
East	Rural	157920	0.25	7.71	9.00
	Urban	107096	1.81	7.71	9.00
West	Rural	247977	1.04	7.89	9.00
	Urban	63134	1.52	7.89	9.00
North-East	Rural	39392	0.93	6.43	9.00
	Urban	9655	2.43	6.43	9.00
India	Rural	900973	0.97	7.70	9.00
	Urban	425182	2.05	7.70	9.00

* Data source: Registrar General of India, BAU: Business as usual scenario, HGR: High growth scenario.

APPENDIX 2
ESTIMATED PARAMETERS OF FIRST STAGE OF DEMAND SYSTEM

	North		West		South		East		North-East		India	
Parameters	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Intercept	1.283	1.519	1.119	1.616	1.042	1.086	1.034	1.598	1.506	1.460	1.237	1.514
	(0.030)	(0.037)	(0.031)	(0.033)	(0.028)	(0.040)	(0.024)	(0.038)	(0.051)	(0.072)	(0.013)	(0.018)
Food prices	0.352	0.369	0.233	0.325	0.507	0.438	0.272	0.206	0.307	0.270	0.272	0.273
	(0.010)	(0.012)	(0.009)	(0.010)	(0.011)	(0.016)	(0.008)	(0.013)	(0.014)	(0.021)	(0.004)	(0.006)
Income	0.581	0.532	0.639	0.523	0.541	0.540	0.647	0.582	0.569	0.588	0.611	0.561
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.006)	(0.004)	(0.006)	(0.007)	(0.012)	(0.002)	(0.003)
Family size	-0.009	-0.012	-0.005	-0.013	-0.010	-0.006	-0.003	-0.006	-0.006	-0.014	-0.005	-0.008
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)	(0.000)	(0.001)
Age	0.001	0.001	0.001	0.001	0.000#	0.001	0.001	0.001	0.000#	0.000#	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child proportion	-0.128	-0.138	-0.070	-0.130	-0.148	-0.117	-0.071	-0.074	-0.053	-0.072	-0.082	-0.107
	(0.010)	(0.012)	(0.010)	(0.012)	(0.010)	(0.014)	(0.008)	(0.014)	(0.013)	(0.022)	(0.005)	(0.006)
R^2	0.760	0.814	0.745	0.799	0.775	0.784	0.813	0.816	0.670	0.786	0.763	0.792
No. of observations	14334	8330	13244	9302	14080	8382	15985	6400	5739	1967	63382	34381

Figures in parentheses are standard error of respective parameter, *Significant at 5 per cent level of significance.

non-significant, and All other parameters at significant at 1 per cent level of significance.

Estimated parameters for 2nd stage of demand system could not be given due to paucity of space and can be obtained from authors (shivendraiari@gmail.com) if required.