International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 8, Issue 2, 2016, pp.-968-972.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

DEMAND PROJECTIONS FOR FOODGRAINS IN KARNATAKA-VISION 2020, INDIA

LAKSHMI NARSIMHAIAH[1*], CHANDRASHEKAR H.[2], RAGHAVENDRA D.V.[3], ADARSHA L.K.[4], SATHISH G.[1] AND SATHISH Y.[5]

[1]Department of Agril. Statistics; [4]Department of Agril. Economics, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Nadia, West Bengal, 741252, India
[2]Coordinator, Project Planning and Monitoring Cell, University of Agricultural Sciences, Bangalore, Karnataka, 560065, India
[3]Department of Agril. Economics, University of Agricultural Sciences, Raichur, Karnataka, 584104, India
[5]Department of Agril. Statistics, BHU, Varanasi, Uttar Pradesh, 221005, India
*Corresponding Author: Email- lakshmi.narasimhaiah1988@gmail.com

Received: January 08, 2016; Revised: January 17, 2016; Accepted: January 19, 2016

Abstract- The issue of food security is debated world over with increase in population and it has become important agenda in many of the international forums. Karnataka is one among the highly populated states of India on which the present study focused upon projecting the demand for major food grains (cereals and pulses) up to year 2020, by making use of district level cross-section data of 64th round consumer expenditure survey which is published by National Sample Survey Organization (NSSO) during 2007-08 which facilitated to capture the regional variation in composition of food basket. The demand estimates are derived based on growth of population, per capita income and income elasticity of demand. Engel curves like Log–inverse, Double–log, Log-log–inverse, Linear, Quadratic and Semi-log models were used for computing expenditure elasticities. The estimate of demand with respect to rice, wheat, jowar, ragi, gram, and tur by the end of 2016 found to be 42.9, 11.1, 7.2, 6.6, 0.46 and 5.3 lakh tons respectively and by the end of 2020 it was found to be 57.4, 14.2, 6.1, 6.8, 0.50 and 7.2 lakh tons respectively. These results may help policy makers of the state to narrow down the supply-demand gap of food grains under consideration.

Keywords- Demand, Food grains, Projection, Engel curves.

Citation: Lakshmi Narsimhaiah, et al., (2016) Demand Projections for Food grains In Karnataka-Vision 2020, India. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 8, Issue 2, pp.-968-972.

Introduction

Agriculture is an important sector of Indian economy accounting for 14 per cent of nations GDP during 2013-14, Anonymous [1]. About half of the population is either wholly or significantly dependent for their livelihood on some form of farm activity. Thus agriculture growth is considered very important for pro poor and inclusive development. The questions often posed by policy makers is whether India will be able to feed herself and continue to be self sufficient in food grains production, since higher economic growth and significant addition to the population will increase demand for food. Various studies on population trends and projection found India as most populous country by the forth-coming decades in the world, Anonymous [2]. Demand as well as supply prospects of food items become very significant indicators of country's food security concerns by Surabhi Mittal [3]. Purnamita and Smita [4] have foreseen while studying the India's food security concern that the gap between increasing demand on one side and supply constrains on the other have to be filled through increased imports. A detailed study at disaggregated level, preferably at state level will be more helpful, as formation of states has mainly taken into account the prevailing regional and cultural diversities by Singh [5].

Karnataka in terms of geographical size stands eighth position accounting for 5.83 per cent of geographical area, 5.05 per cent total of population and 5.50 percent of the GDP of the country, Anonymous [1]. Karnataka has varied topography and physiographic features. Major food crops grown in the state are, paddy, jowar, ragi, maize, bajra, red gram and bengal gram. With the impending food security issue, policymakers recognize the urgent need to estimate the future demand of food items in Karnataka.

Most of the studies undertaken for demand projections do differ in terms of model chosen by the researchers and its variants, Praduman Kumar [6]. Coming to the cross-section data based demand projections Engel curves relating to per capita item expenditure are more realistic in Indian situation upto projection period of 10 years due to Sandhu [7]. The present study makes modest attempt to project the important food grains demand up to 2020 for the state of Karnataka.

Materials and Methods:

Present investigation makes use of the secondary data of household consumer expenditure from the 64th round of National Sample Survey for Karnataka state, Anonymous [8]. The cross sectional data, district wise are collected and the variables considered are monthly per capita consumer expenditure, quantity of consumption and value of consumption. Each of the above variables considered contributed 27 data points. The data on district wise population for both rural and urban Karnataka is collected from census of India for the year 2001 and 2011 and used for projecting the district wise population up to 2020. The total population projection is done and expressed in adult units by considering two children as equivalent to one adult unit since dietary requirements are usually given in terms of adult units. Population of children's in the age group of 0-14 is collected for this purpose, Anonymous [9] and same proportion of children is assumed for estimating adult population up to 2020. For the convenience of the study, the districts of the state have been classified into three major regions based on information of 10 agro-climatic zones of Karnataka, region wise projections are made which is later aggregated to estimate the state population. District wise projections are made for rural and urban areas and later they are aggregated to get region wise projected population figures. Projection is made using the formulae

$$A = P\left(1 - \frac{r}{100}\right)^t$$

Where A = Amount, P = Principal, r = Compound growth rate, t = Time.

Gross State Domestic Product (GSDP) at Factor Cost by Industry of Origin in

Karnataka (At Constant 2004-05 Prices, 2004-05 to 2011-12) is collected from Directorate of Economics and Statistics, Bangalore, which is used for the computation of rate of growth in per capita income for the state. Per capita income growth for the Karnataka state as a whole is obtained by two steps. In the first step we fitted the regression of GSDP of state on time by using the functional form

$$Ln(GSDP\ of\ state) = \alpha + \beta(t) + \varepsilon$$

by using ordinary least square (OLS) technique and the regression coefficients obtained was tested for the significance using the student's 't' test.

And in the second step we obtained the Compound growth rate (CGR) in percentage by using the coefficient of the above fitted regression model using the relationship,

$$CGR = \left[Exp(\beta) - 1\right] * 100$$

Similarly per capita income growth for the rural Karnataka is computed by fitting regression of GSDP from agriculture on time as follows

$$Ln(GSDP\ from\ agriculture) = \alpha + \beta(t) + \varepsilon$$

Where t = time and ε = Random disturbance term.

The growth of GSDP from agriculture is taken as proxy for income growth of rural Karnataka by Praduman Kumar [10].

Per capita income growth for urban Karnataka is assumed to be three times that of rural Karnataka due to Praduman Kumar [10].

The functional relationships presented in [Table-1] are used to obtain the expenditure elasticities of demand for different food items. Income Elasticity (E_P) of demand is the degree of responsiveness of demand to a change in its income.

In mathematical terms, it can be represented as: $E_P = \frac{\Delta q}{\Delta p} * \frac{p}{q}$

Table-1 *Different functional forms used for computation of expenditure elasticities.*

Functional Form	Expression of Function	Elasticity
Log –inverse	$Ln(Y) = a - b * \left[\frac{1}{X}\right] + u$	$\frac{b}{\overline{X}}$
Semi- log	$Y = a + b * Ln(X) + u$	$\frac{b}{\overline{Y}}$
Double –log	$Ln(Y) = a + b * Ln(X) + u$	b
Log-log –inverse	$Ln(Y) = a + b * Ln(X) + c * \left[\frac{1}{X}\right] + u$	$\frac{\left[b * \overline{X} - c\right]}{\overline{X}}$
Linear	$Y = a + b * X + u$	$\frac{b * \overline{X}}{\overline{Y}}$
Quadratic	$Y = a + b * X + c * X^2 + u$	$\left[b + 2 * c * \overline{X}\right] * \left[\frac{\overline{X}}{\overline{Y}}\right]$
Transcendental	$Y = a * \left[X^b\right] * \left[e^{cX}\right] + u$	$b + c * \overline{X}$

Where, Y is the Per capita monthly expenditure on a specific food item in rupees, X is the Per capita monthly total consumption expenditure in rupees. a, b and c are the regression coefficients and u is random error term.

Table-2 *Estimated district wise adult population compound growth rates (percent) in Karnataka.*

Sl. No.	Zone	District	Urban	Rural	Total
1	DRY ZONE	Bagalkote	2.27	0.97	1.36
2		Bijapur	2.37	1.73	1.87
3		Gulbarga	2.13	1.66	1.79
4		Raichur	1.48	1.42	1.43
5		Koppal	1.65	1.50	1.52
6		Gadag	1.05	0.85	0.92
7		Bellary	2.66	2.02	2.25
8		Chitradurga	1.82	0.69	0.90
9		Davangere	1.48	0.55	0.84
10		Tumkur	1.74	0.01	0.37
11		Kolar	2.00	0.62	0.98
12		Bangalore-Urban	4.23	1.12	3.91
13		Bangalore-Rural	2.76	0.41	0.96
14		Mandya	0.89	0.13	0.25
15		Mysore	2.35	0.57	1.26
16	TRANSITIONAL ZONE	Belgaum	1.80	1.09	1.26
17		Bidar	2.07	0.98	1.24
18		Dharwad	1.76	0.99	1.42
19		Haveri	1.76	0.86	1.06
20		Hassan	2.15	-0.13	0.31
21		Chamarajnagar	1.70	0.34	0.56
22	HILLY & COASTAL ZONE	Uttara Kannada	0.76	0.53	0.60
23		Shimoga	0.88	0.55	0.67
24		Chikmagalur	0.74	-0.22	-0.03
25		Kodagu	0.73	0.01	0.11
26		Udupi	4.94	-0.71	0.58
27		Dakshina Kannada	3.12	-0.68	0.94

Here due to the lack of consumer income data to obtain the income elasticities the monthly per capita total consumption expenditure has been used as proxy for income.

The expenditure elasticities (e_x) for each food items are derived from the derivatives of each equation with respect to expenditure as follows.

$$e_x = [dY/dX]*[X/Y]$$

The evaluated elasticities (e_x) at the sample mean values for X and Y are presented in the [Table-1] for different functions respectively. All the functions are fitted to the data and better fit was decided based on high coefficient of determination (R^2) and low value of standard errors of the coefficients.

Demand projections for various food items under study are based on equation:

$$D_t = d_0 * N_t [1 + y * e]^t$$

Where, D_t represents commodity demand by the household in year t, d_0 is the base year per capita demand of the commodities, y is the per capita income growth, e is expenditure elasticity of demand for the commodity and N_t is the population projected in year t

Results and Discussion:

The estimated district wise compound growth rates for adult population for the period 2001 to 2011 are presented in [Table-2]. Compared to the rural areas it is evident that the urban sector has a high growth rates in the population. [Table-3] provides the adult population projection up to 2020 for both urban and rural areas for considered different regions and over all Karnataka.

The growth rates estimated for over all state income and agriculture GSDP are presented in the [Table-4]. Income growth for state is found to be 8.07 percent whereas the income growth for rural sector of state found as 5.12 per cent.

Table-3 *Region wise adult population projection (lakhs) for Karnataka*

Year	Dry zone		Transitional zone		Hilly/coastal zone		Karnataka	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
2012	196.31	151.08	77.90	30.98	46.18	23.26	320.40	205.31
2013	198.19	155.85	78.51	31.55	46.16	23.77	322.86	211.17
2014	200.10	160.79	79.13	32.13	46.13	24.30	325.35	217.23
2015	202.03	165.92	79.75	32.73	46.10	24.84	327.88	223.49
2016	203.99	171.22	80.38	33.33	46.08	25.41	330.44	229.96
2017	205.97	176.72	81.01	33.95	46.05	25.99	333.04	236.65
2018	207.99	182.41	81.65	34.58	46.03	26.59	335.67	243.57
2019	210.03	188.31	82.30	35.22	46.01	27.21	338.33	250.73
2020	212.10	194.43	82.95	35.87	45.99	27.85	341.03	258.14

Table-4 *Estimates of overall and rural income in Karnataka (2004-2011)*

Coefficients	State	Rural
Intercept (A)	16.58* (0.0249)	14.75* (0.0309)
Slope (B)	0.08* (0.0049)	0.05* (0.0061)
R^2	0.98	0.92

Note: Data in the parenthesis indicates standard error. *Indicates significance at 5 percent level of significance

The results of the parameter estimates of different functional forms utilized for computation of expenditure elasticities for major food crops for rural and urban Karnataka are presented in [Table-5]. From rural section of [Table-5] it's observed that Log Inverse emerged as better functional form for rice and ragi. Semi-log function turned out to be better fit for wheat and gram. While quadratic form turned out to be better, fit for jowar. The estimated results show that the coefficients of the explanatory variable are significant for rice and wheat, whereas in case of ragi only intercept is significant at level of significance of 5 percent. In case of jowar, quadratic term has negative significant coefficient. The demand function for gram

Table-5 *Expenditure Elasticity for Selected Food Crops for Rural and Urban Karnataka (2007-08)*

Sl. No.	Item	Rural						Urban					
		Functional form	A	B	C	R2	Elasticity	Functional form	A	B	C	R2	Elasticity
1	Rice	Log-Inverse	5.21* (0.33)	845.95* (254.34)	-	0.31	0.97	Log-Inverse	4.80* (0.27)	391.2 (207.99)		0.13	0.45
2	Wheat	Semi-Log	-74.62* (33.6)	13.73* (4.99)	-	0.23	0.78	Log-Inverse	3.39* (0.31)	273.19 (232.78)	-	0.05	0.31
3	Jowar	Quadratic	-156.48 (116.46)	0.53 (0.28)	-0.0004* (0.0002)	0.32	-0.64	Quadratic	34.97 (48.48)	-0.009 (0.1)	-9.13 (4.8)	0.13	-0.91
4	Ragi	Log-Inverse	2.19* (0.76)	-379.31 (640.02)	-	0.03	-0.38	Log-Inverse	2.5* (0.63)	4.59 (503.77)	-	0.04	0.0048
5	GRAM	SEMI-LOG	-8.37 (9.71)	1.63 (1.44)	-	0.05	0.63	Semi-Log	10.07 (18.15)	-1.03 (2.68)	-	0.05	-0.33
6	TUR	SEMI-LOG	-2.35	1.51* (0.15)	-	0.89	0.76	SEMI-LOG	-1.72	1.36* (0.14)	-	0.83	0.58

Note: Figures in the brackets represent the standard error of the estimates. *Significant at 5 percent level.

could capture only five percent of the variation with none of the coefficient being significant. We may note here that other functional forms also did not provide better fit for gram.

From [Table-5] it's observed that the estimated results show that the intercept is significant in the case of rice, wheat and ragi at 5 percent level of significance. The slope coefficient did not register statistical significance for none of the major commodities considered for the analysis. Despite this fact these functional forms are considered to derive expenditure elastisities as they had better R^2 value compared to the other functional forms fitted for these commodities.

In the case of urban sector jowar and gram have shown a negative expenditure elasticity of demand and it is associated with inferior goods; Whereas rice, wheat and ragi have shown a positive expenditure elasticity of demand and it is associated with normal goods; For gram none of the functional forms have turned out to be significant in which case we considered the Semi-log functional form to estimate expenditure elasticities as per Kannan and Chakrabarthy [11]. In case of jowar also none of the functional forms have shown significant in which case we considered quadratic form based on R^2 and standard error.

In the absence of cross sectional district wise data on rural (and urban) consumption pattern for tur, for the purpose of estimation of expenditure elasticity for the rural (and urban) Karnataka, the estimate given by Kannan and Chakrabarthy [11] for pulses for All India rural (and urban) has been taken as proxy for the expenditure elasticity for tur for rural (and urban)Karnataka.

The average over the districts falling under different Agro-ecological regions for rural and urban areas is calculated to get region wise yearly per capita demand. The region wise estimates so obtained are aggregated to arrive at state figures for urban and rural areas during the base year and the results are presented in [Table-6]. In the absence of data on per capita demand of the tur in the base year 2007-2008 for rural and urban sector, the per capita requirement at 1979-80 as base (kgs per person per year) given by Anonymous [12] is considered for both rural and urban sectors.

Table-6 *Per Capita Demand of the Foodgrains in the Base Year 2007-2008 (in kg/person/year)*

Sl. No.	Item	Dry region		Transitional region		Hilly -coastal region	
		Rural	Urban	Rural	Urban	Rural	Urban
1	RICE	51.08	52.29	50.28	53.71	107.35	89.81
2	WHEAT	14.64	18.29	14.68	18.73	13.48	16.1
3	JOWAR	23.36	16.41	22.29	13.41	3.44	0.60
4	RAGI	17.78	12.96	7.09	7.39	5.32	4.55
5	GRAM	0.56	0.48	0.91	3.07	1.24	1.38
6	TUR	7.00	7.00	7.00	7.00	7.00	7.00

Source: NSS 64th round, Directorate of Economics and Statistics, Bangalore.

Table-7 *Projected Demand of major Foodgrains up to 2020 for Karnataka (In lakh tons)*

	Rural						Urban						Total state					
YEAR	RICE	WHEAT	JOWAR	RAGI	GRAM	TUR	RICE	WHEAT	JOWAR	RAGI	GRAM	TUR	RICE	WHEAT	JOWAR	RAGI	GRAM	TUR
2012	19.8	4.8	6.3	4.2	0.25	2.3	12.5	3.9	2.5	2.3	0.19	1.6	32.3	8.7	8.8	6.5	0.44	3.9
2013	21.0	5.1	6.1	4.2	0.26	2.4	13.7	4.2	2.2	2.4	0.18	1.8	34.6	9.3	8.3	6.5	0.45	4.2
2014	22.1	5.3	6.0	4.1	0.27	2.6	15.0	4.5	2.0	2.4	0.18	2.0	37.2	9.8	7.9	6.6	0.45	4.5
2015	23.4	5.6	5.8	4.1	0.28	2.7	16.5	4.9	1.7	2.5	0.17	2.2	39.9	10.4	7.6	6.6	0.46	4.9
2016	24.7	5.8	5.7	4.0	0.30	2.8	18.2	5.3	1.5	2.6	0.17	2.5	42.9	11.1	7.2	6.6	0.46	5.3
2017	26.1	6.1	5.5	4.0	0.31	2.9	20.0	5.7	1.4	2.7	0.16	2.8	46.1	11.8	6.9	6.7	0.47	5.7
2018	27.6	6.4	5.4	3.9	0.32	3.1	22.0	6.1	1.2	2.8	0.16	3.1	49.6	12.5	6.6	6.7	0.48	6.2
2019	29.2	6.7	5.3	3.9	0.33	3.2	24.2	6.6	1.1	2.8	0.15	3.5	53.3	13.3	6.3	6.7	0.49	6.7
2020	30.8	7.0	5.1	3.9	0.34	3.4	26.6	7.1	0.9	2.9	0.15	3.9	57.4	14.2	6.1	6.8	0.50	7.2

The total demand projection of major food crops for plan periods up to 2020 are presented in [Table-7]. The demand for rice and wheat is estimated to reach 42.9 and 11.1 lakh tons by the end of 2016 and by the end of 2020 the demand for rice and wheat is expected to increase to 57.4 and 14.2 lakh tons respectively. The demand for rice from rural sector is expected to be high as compared to the demand from urban sector for the period under consideration. The demand for wheat from rural sector is also expected to be high as compared to the demand by urban sector up to 2019, but while approaching the end of 2020 the demand from urban sector is marginally higher than the rural sector. The demand for jowar is estimated to decrease from 8.8 lakh tons in 2012 to 7.2 lakh tons by 2016, and by the end of 2020 the demand for jowar is further expected to decrease to 6.1 lakh tons. The demand is found to be high in case of rural sector when compared with urban sector for the period under consideration. The rate of decrease in demand for jowar in case of urban sector is considerably high. The demand for ragi and gram increased by almost negligible amount from 6.5 lakh tones and 0.44 lakh tones in 2012 to 6.6 lakh tons and 0.46 lakh tons by the end of 2016 respectively. And by the end of 2020 the demand for ragi and gram is expected to be 6.8 lakh tons and 0.50 lakh tons respectively. The demand for both ragi and gram is found to be high in rural sector for the projected period. The decline in demand for jowar and ragi may be attributed to substitution effect. It has been widely discussed in the literature that as income increases household tend to shift the consumption towards superior cereals like rice and wheat from the coarse cereals. This may also be due to effect of Public Distribution System in the country where households below poverty line both in urban and rural areas are distributed rice and wheat. The demand for tur in the state is estimated to increase steadily from 3.9 lakh tons in 2012 to 5.3 lakh tons by 2016, and by the end of 2020 the demand for tur is expected to further increase by having its projected demand value 7.2 lakh tons. It is observed that the demand for tur in 12th five-year plan period will be more in rural sector. The difference in demand between rural and urban sector is expected to narrow down during 2017 and in 2018 the demand will be same i.e., 3.1 lakh tons for both for rural and urban areas, there by the demand from urban sector for tur will be more as compared to the rural sector.

Conclusion:

The salient findings of the study hence conclude that the dry zone was estimated to have high population growth followed by transitional and hilly-coastal zone for the study period. The demand for rice and wheat was expected to increase, whereas it decreases in case of jowar over the projection period under consideration. The demand for ragi and gram increased by almost negligible amount over the projection period under consideration. The demand for tur in the state was estimated to increase steadily over the projection period under consideration. The results can be very well used for making policy decisions of the state.

Conflict of Interest: None declared

References

[1] Anonymous (2015a) *www.indiastat.com , Last assessed* on 15/11/2015.
[2] Anonymous (2015b) *World Population prospects: The 2015 Revision, Key Findings and Advance Tables, Working paper No. ESA/P/WP.241, Department of economics and social affairs, Population division, United Nations.*
[3] Surabhi Mittal (2008) *Demand-Supply Trends and Projections of Food in India, Working Paper No. 209, Indian Council for Research on International Economic Relations, New Delhi*.
[4] Purnamita Dasgupta and Smita S. (2010) *Indian Agricultural Scenario and Food Security Concerns in the Context of Climate Change: a Review, Online at http://mpra.ub.uni- muenchen.de/24067/MPRA Paper No. 24067, posted 23. July 2010 03:02 UTC*.
[5] Singh D.R. (2011) *Demand and Supply Projections for Food Commodities: A Disaggregated Analysis, Division of Forecasting and Econometric Techniques, Indian Agricultural statistics Research Institute (ICAR), New Delhi.*
[6] Praduman Kumar (1998) *Food demand and supply projections for India, Agricultural Economics policy paper 98-01, IARI, New Delhi*.
[7] Sandhu H.S. (1984) *Asian Economic Review,* 26(3), 57-65.
[8] Anonymous (2010) *Household consumer expenditure in Karnataka, 2007-2008 (state sample), NSS 64th round (July 2007-June 2008), Directorate of Economics and Statistics, Department of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India*.
[9] Anonymous (2002) *The Indian child profile (2002), Dept of women and Child Development, Ministry of HRD, Govt of India*.
[10] Praduman Kumar, Joshi P.K. and Pratap Birthal S. (2009) *Agricultural Economics Research Review*, 22, 237-243.
[11] Kannan R. and Chakrabarthy T.K. (1983) *Economic and Political Weekly*, 18(52&53), 4135-4142.
[12] Anonymous (1989) *Karnataka: Perspective plan 2001 Vol.II. Report of the expert group*, pp.89-144.