ARTHAVAAN
Volume 4, Issue 1, December 2021

http://www.bharaticollege.du.ac.in

Role of Weather Shock and Variability on Food Security in India

Kaveri Khound [1]
[1]*Research Scholar, NEHU, Shillong, Email: kaverikhound100@gmail.com*

Abstract : *Food insecurity is one of the major causes of concern confronting the world. Despite the significant progress that India has made over the last 50 years, most of the populations or communities have to deal with uncertainties of food security on a daily basis year after year. Attaining food security is a matter of prime importance in India since more than a third of its population is estimated to be absolutely poor, and as many as one half of its children have suffered from malnourishment over the last three decades. The comprehensive studies on food security revealed that in India, studies have been made on food security, its determinants and challenges to food security. But till date, no study has been carried out for examining the extent of food insecurity across different socio-economic classes in rural India. The objective of this paper is to examine and quantify the extent of food insecurity in rural India and its variations across states and various social and religious groups. It further intends to identify the factors that affect household level food insecurity and impact of weather shock and variability on food insecurity in rural India.*

I. Introduction

Food insecurity is one of the major causes of concern confronting the world today. It is inherently interlinked with other current global challenges of the economy. Food security is said to exist when all people at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs for an active and healthy life (FAO,2009). Despite the significant progress that India has made over the last 50 years, most of the populations or communities have had to deal with uncertainties of food security on a daily basis year after year, most often generation after generation. With a population approaching almost 1.2 billion in 2010, India is likely to be the most populous country by 2030 with 1.6 billion people. It currently accounts for more than 17% of the global population and 456 million poor, or 41.6% living on less than $1.25 a day. The need for achieving food security is felt significantly in recent years due to heavy pressure from the increasing population in India. India after 66th independence has not only seen development and progress but also becoming one of the fastest growing economies of the world. Attaining food security is a matter of prime importance in India where more than a third of its population is estimated to be absolutely poor, and as many as one half of its children have suffered from malnourishment over the last three decades (Upadhyay and Palanivel, 2011). Though after green revolution in 1960s, initiated a historic watershed that transformed the agriculture sectorin India, a closer look at the experience in the last two decades however indicates a decline in both production and yield (Ittyerah, 2013). In the Global Hunger Index 2013, India ranked 63rd out of 120 countries though India is one of the largest producers of food in the world. Still India is not in the condition to meet the basic food requirements of people (Jaswal, 2014). There are many people in India who strive hard even for the square meals.

There have been various studies on India with respect to food security in general and its determinants and challenges in particular. Kattumuri (2016) analyzes the impact of Targeted Public Distribution System (TPDS) on food security in India and has found that

though TPDS and mid-day meal schemes have been implemented by the government of India, but the results of these schemes are not at all satisfactory. About twice and as many as children suffer from hunger and malnutrition till date. Dev and Sharma (2010) and Jaswal (2014) examine India's progress in the main three dimensions of food security- availability, accessibility and absorption (utilization) of food and have found that till now approximately 320 million Indians go to bed without food every night. Though India produces lots of food grains, but those food grains are not sufficient enough to meet the hunger and also not affordable for the poor. According to the authors, the main reasons behind this are inadequate and improper storage facilities for grains, insufficient cold storage and cold chain transportation system, poor roads and insufficient transport system, limited reach to Mandis, multiple layers of middlemen between the farmers and consumers and lack of well-developed banking sector. On the other hand, while studying the challenges to food security in India, Brahmanand et al (2016) have found that crop diversification, bio- fuel and medicinal plant cultivation, climate change, mismatch between water demand and availability etc are the major challenges to food security. owing to scarce resources and markets needed to obtain agricultural stability. Besides The main reason behind this existing food insecurity in India is lack of improvement in agricultural productivity this, inadequate distribution of food through public distribution mechanisms, unmonitored nutrition programmes and lack of inter sectoral coordination are also a reason for growing food insecurity in the country (Upadhyay&Palanivel, 2011). Studies have also been made to analyze the determinants of food security in India by Chakravarty and Dand (2005), Agarwal et al (2009) and Mukherjee (2016). In their studies, they have found that the major determinants of food security in India are religion, family size, household literacy level, income per capita, socio-economic status, consumption expenditure per adult, dependency ratio, total cultivated land holdings, sex of the household etc.

The comprehensive studies on food security revealed that in India, studies have been made on food security, its determinants and challenges to food security. But till date, no study has been carried out for examining the extent of food insecurity across different socio economic classes in rural India. This study has been taken up to fill this gap to some extent.

The objective of this paper is to examine and quantify the extent of food insecurity in rural India and its variations across states and various social and religious groups. It further intends to identify the factors that affect household level food insecurity and impact of weather shock and variability on food insecurity in rural India.

The paper is organized in six sections. Section two outlines the materials and methods. Section three discusses the extent of food insecurity in India and its variations across space and various social and religious groups. Section four outlines the model with a brief explanation of the variables of interest. Section five discusses the regression results whereas section six deals with concluding remarks.

II. Material and Methods

This study is completely based on secondary data. The secondary data has been collected from the second round of India Human Development Survey (IHDS-II) for the year 2011-12. The IHDS provides data at the household level on a number of dimensions and variables. The data were thoroughly cleaned and a few variables relevant for the present paper were taken into account and a few others created from the available data. A detailed analysis of the variables used in the paper is provided in Section IV.

The main objective of the paper is concerned about household level food insecurity. Hence household level food insecurity is measured as follows. The report of the Expert Group (Rangarajan) to the Planning Commission (Government of India, 2014) has outlined the normative requirements of expenditures on food

comprising calories, proteins and fats. We have taken this recommended expenditure (per capita per month) on calories, proteins and fats as the benchmark for measuring food insecurity. Thus, the national food insecurity lines have been defined as the monthly per capita food expenditure (calorie+protein+fat) of Rs 554 in rural areas and Rs 656 in urban areas. These food insecurity lines are then adjusted by price indices to estimate state specific food insecurity lines. On the basis of these food insecurity lines an aggregate measure of food insecurity is obtained. The national and state specific food insecurity lines along with poverty lines are shown in Table 1. A household whose per capita monthly expenditures on calories, proteins and fats are less than this benchmark are considered to be food insecure.

Table 1: National and State Specific Lines for Poverty and Food Insecurity

States/ Union Territory	Poverty Line		Food Insecurity Line	
	Rural	Urban	Rural	Urban
Andhra Pradesh	1031.74	1370.84	588.05	639.14
Arunachal Pradesh	1151.01	1482.94	656.03	691.41
Assam	1006.66	1420.12	573.75	662.12
Bihar	971.28	1229.3	553.59	573.15
Chhattisgarh	911.8	1229.72	519.69	573.34
Delhi	1492.46	1538.09	850.64	717.12
Goa	1200.6	1470.07	684.29	685.41
Gujarat	1102.83	1507.06	628.57	702.65
Haryana	1127.82	1528.31	642.81	712.56
Himachal Pradesh	1066.6	1411.59	607.92	658.14
Jammu & Kashmir	1044.48	1403.25	595.31	654.25
Jharkhand	904.02	1272.06	515.25	593.09
Karnataka	975.43	1373.28	555.95	640.28
Kerala	1054.03	1353.68	600.75	631.14
Madhya Pradesh	941.7	1340.28	536.73	624.89
Maharashtra	1078.34	1560.38	614.61	727.51
Manipur	1185.19	1561.77	675.51	728.16
Meghalaya	1110.67	1524.37	633.04	710.72
Mizoram	1231.03	1703.93	701.64	794.44
Nagaland	1229.83	1615.78	700.95	753.34
Orissa	876.42	1205.37	499.52	561.99
Punjab	1127.48	1479.27	642.62	689.70
Rajasthan	1035.97	1406.15	590.46	655.60
Sikkim	1126.25	1542.67	641.92	719.25
Tamil Nadu	1081.94	1380.36	616.66	643.58
Tripura	935.52	1376.55	533.21	641.80
Uttar Pradesh	889.82	1329.55	507.16	619.89
Uttarakhand	1014.95	1408.12	578.48	656.52

West Bengal	934.1	1372.68	532.40	640.00
Puducherry	1130.1	1382.31	644.11	644.49
Andaman & Nicobar Islands	1314.98	1797.69	749.48	838.16
Chandigarh	1303.17	1481.21	742.75	690.60
Dadra & Nagar Haveli	1008.39	1540.81	574.74	718.39
Daman & Diu	1200.6	1434.93	684.29	669.02
Lakshadweep	1327.77	1458.69	756.77	680.10
All India	972	1407	554	656
Sources: a) Poverty lines – Government of India (2014) b) Food Insecurity Lines – Calculated by the author from IHDS-II				

III. Food Insecurity in India: Extent and Variations

The variations in food insecurity across different castes and religions are shown in Fig. 1 and Fig. 2 respectively. It is evident from these figures that there are wide variations in the prevalence of food insecurity across social and religious groups in rural India.

Fig. 1: Food Insecure Households (%) by Caste

Source: Calculated by authors from IHDS-II

Fig. 2: Food Insecure Households (%) by Religion

Source: Calculated by authors from IHDS-II

As far as the social groups are concerned, food insecurity is the highest for scheduled tribes with around 49% of its households are food insecure. In case of scheduled castes around 38% of the households are food insecure which is followed by other backward castes (30.68%). Food insecurity is the lowest in case of other caste people as percentage of insecure households belonging to this is only around 16%. Such differences in the extent of food insecurity reflect the economic inequalities among these classes.

Fig. 2 highlights the differences in the level of food insecurity across various religious groups in India. The point to be noted here is that for the convenience of our analysis we have grouped Buddhists, Jains, Tribals and other small religious groups into one group and named it as 'Other Religion' due to the fact each of its constituents represent a very small proportion of the sample households compared to other major religions. It is seen form Fig. 2 that food insecurity is highest among the Hindu religion people (32.3%) followed by Christians (29.01%). Food insecurity is lowest among the Sikhs (13.1%). It is interesting to note that there is not much variations across the other two major religions.

The extent of food insecurity and its spatial variations are captured by Head Count Ratio (HCR) which has been shown in Table 1. As seen from the table 31.49% of the sample households covering the rural India are food insecure. No sample household in Goa and Tripura are found to be food insecure. The highest food insecurity is found to be in Chhattisgarh with 67.72% of its sample households being food insecure. This is followed by Meghalaya (63.21%). Other states with food insecurity higher than the national average are Uttar Pradesh (31.51%), Assam (33.02%)Maharashtra (38.64%),Tamil Nadu (41.92%), Uttarakhand (43.21%), Jharkhand (44.51%), Bihar (45.44%) and Odisha (54.25%)

Table 1: Spatial Variations in Food Insecurity in rural India

State/UTs	Head Count Ratio (HCR) (In percentages)	Food Insecurity Gap Index
All India	*31.49*	
Goa	0	0
Tripura	0	0
Jammu & Kash-mir	4.5	0.009

Pondicherry	4.9	0.007
Nagaland	5.56	0.008
Sikkim	8.33	0.001
Daman & Diu	10.17	0.011
Punjab	13.17	0.021
Mizoram	16.67	0.020
Arunachal Pradesh	19.20	0.035
Gujrat	20.39	0.044
Andhra Pradesh	20.75	0.041
Karnataka	21.41	0.045
Kerala	21.85	0.050
Himachal Pradesh	22.09	0.049
Haryana	23.11	0.040
Rajasthan	24.26	0.059
Manipur	26.19	0.025
West Bengal	26.67	0.057
Uttar Pradesh	31.51	0.070
Assam	33.02	0.069
Dadra & Nagar Haveli	38.46	0.115
Maharashtra	38.64	0.096
Madhya Pradesh	39.20	0.112
Tamil Nadu	41.92	0.125
Uttarakhand	43.21	0.123
Jharkhand	44.51	0.124
Bihar	45.44	0.114
Orissa	54.25	0.144
Meghalaya	63.21	0.201
Chhattisgarh	67.72	0.226

In this study the depth of food insecurity has been captured by the Food Insecurity Gap Index (FIGI). From the above table it is found that the depth of food insecurity is also highest in Chhattisgarh (0.226) followed by Meghalaya (0.201).In the states like Odisha (0.144), Tamilnadu (0.125), Jharkhand (0.124), Bihar (0.114) and Madhya Pradesh (0.112), food insecurity is deeper as compared to other states.

The district level analysis of spatial variations and depth of food insecurity is given in the appendix section.

IV. The Model:

To examine the determinants of food insecurity, a binary logistic regression model is used. The model is ---

Where, w' is a vector of weather-related variables (e.g. flood, drought, mean daily average temperature etc.), x' is a vector of other explanatory variables representing different socio-economic variables. and are vector of coefficients of the weather variables (w) and other explanatory variables (x) respectively. Finally represents the intercept, u refers to the disturbance term and i(i=1,2, 3,……..,n) refers to the households.

Here, the dependent variable FI_i indicates food insecurity status of the i^{th} household which takes on value 1 if a household is food insecure and 0 otherwise.

The definitions of the explanatory variables are explained below:

Dummy variable is used to capture the differential impact of the variable Hill on food insecurity. Dummy takes the value '1' if the household resides in hilly region, '0' otherwise.

Household size can be defined as number of persons living in one house. Larger sized households have more mouths to feed and hence have lesser availability of food consumption per capita. An increase in household size increasesthe probability of food insecurity.

The per capita income of each household is obtained by dividing its total annual income by the number of household member. Higher the per capita income, higher will be the capacity of the household to consume food items. Thus, per capita income is expected to have a negative impact on food insecurity.

Poverty is an important determinant of food insecurity. To capture the impact of poverty on food insecurity, dummy variable is used which takes the value '1' if household is poor, '0' otherwise. It is expected that the poor do not have enough resources to purchase the required amount of food items for their household which raises their probability of being food insecure.

To capture the differential impact of different castes on household level food insecurity, dummy variables are used. The dummy variable takes the value of '1' if a household belong OBC category, '0' otherwise. Similarly, it takes the value '1' if the household belong to SC category, '0' otherwise, takes the value '1' if the household belong to ST category, '0' otherwise and takes the value '1' if the household belong to Other Caste, '0' otherwise. Here General caste is taken as reference category. Generally, it is expected that households belong to General caste are economically stronger and hence they are food secure in comparison to other caste.

Dummy variable is also used to capture the differential impact of religion on food insecurity. Dummy takes the value '1' if the household belongs to Hindu religion, '0' otherwise.

Dependency ratio is defined as the number of young and old dependents as a percentage of working age group members of a household. If dependency ratio is high, there will be more pressure on a household to feed relatively more people by a smaller number of earners in a household. This will reduce the economic capacity of a household to buy enough food for its members. Thus, dependency ratio is expected to increase food insecurity.

Cultivation as the main occupation is also an important determinant of food insecurity. To capture this variable a dummy variable is used, which takes the value '1' if a household's main occupation is cultivation, '0' otherwise. This implies that the household whose main occupation is cultivation are less likely to be food insecure than others. This is quite intuitive. The cultivator households in India are primarily subsistence farmers, and hence allocate a considerable amount of farm produce on household consumption.

To capture the impact of Remittances on food insecurity, dummy variable is used which takes the value '1' if the households get remittances, '0' otherwise. It is expected that remittances into a household reduce its likelihood to be food insecure. This is because receipt of remittances enhances liquidity and hence the household can spend more on food.

V. Regression Results

The results of the binary logistic regression of food insecurity are shown in Table 2. It is to be noted that the odds ratio is reported here rather than the coefficient, and the results are interpreted accordingly.

Table 2: Results of the Binary Logistic Regression

Variables	Odds Ratio	Std. Error
Drought_2011	1.291***	0.057
Flood_2011	0.951	0.040
MeanT	1.128***	0.011
Hill	1.091***	0.041
HS	1.196***	.009
INCOMEPC	0.990***	1.35e-06
Poor	12.31***	0.530
Other Backward Classes	1.322***	0.063
Scheduled Castes	1.590***	0.086
Schedule Tribes	2.010***	0.120
MUSLIM	0.722***	0.048
SIKH	0.633***	0.086
BUDDHIST	1.508**	0.299
DR	1.158***	0.025
Main Cultivation	0.776***	0.028
Remit	0.910**	0.045
Const	0.008***	0.002
Pseudo R squared	28.83%	
LR chi2(15)	9073.25	
Prob> chi2	0.0000***	
Observations	25113	
Note: ***, ** and * represent significant at 1%, 5% and 10% respectively		

The variable *Drought* is found to have positive impact on food insecurity. This means that the probability of food insecurity increases with the increase in drought.

Similarly *Mean Temperature* also effects food insecurity positively. This implies that when mean temperature

rises, the likelihood of food insecurity also rises.

The variable *Hill* is found positive and significant. This implies that the people residing in hilly regions are more food insecure as compared to the plains.

Household Size is found to have a positive impact on food insecurity. This implies that the probability of food insecurity increases with increase in the size of households. Larger sized households have more mouths to feed and hence have lesser availability of food consumption per capita.

Per capita income is found to have a negative impact on the probability of household level food insecurity.An increase in per capita income of the households reduces its probability of food insecurity.

The odds ratio of *Poor* is found to be as high as 12.31. This implies that the probability of food insecurity for the poor households is higher than others. Food insecurity of a poor household is 12.32 times of a non-poor household. This is quite intuitive. The poor do not have enough resources to purchase the required amount of food items for their household which raises their probability of being food insecure.

As far as the differential impact of caste on food insecurity is concerned it is found that compared to general caste, food insecurity is more among *Other Backward Classes* (OBC), *Scheduled Caste* (SC) and *Schedule Tribe* (ST). The odds of being food insecure for a household belonging to OBC, SC and ST are 1.32, 1.59 and 2.01 times, respectively, of a general category household. This is quite expected because usually the general category people are economically better-off than other social classes.

The dummies used to capture differential impacts of religions are also found to have significant coefficients. The odds ratios of the *Muslim* and *Sikh* have turned out to be less than one, and the reverse is found to be true in case of *Buddhist.* This implies that households belonging to the former are less likely to be food insecure compared to *Hindu*. On the other hand, the *Buddhist* have a higher probability of being food insecure than the Hindus.

Dependency Ratio, showing the number of young and adult dependents as a percentage of number of economically active members in the households, is found to increase the probability of food insecurity.

The odds ratio of *Cultivation* is found to be 0.77. This implies that the households whose main occupation is cultivation are less likely to be food insecure than others. This is quite intuitive. The cultivator households in India are primarily subsistence farmers, and hence allocate a considerable amount of farm produce on household consumption.

The odds ratio for *Remittances* has turned out to be 0.91. This implies that remittances into a household reduce its likelihood to be food insecure. More precisely, the households receiving remittances are 9% less likely to be food insecure than others. This is because receipt of remittances enhances liquidity and hence the household can spend more on food.

Finally, the Pseudo R squared is found to be reasonably high at 28.83%.

VI. Conclusion

This paper makes a novel attempt to examine food insecurity in rural India and its variations across space and different social and religious groups. Around 31.49% of the sample household in the country are found to be food insecure with large scale variations across the states and union territories. The percentage of food insecure sample households in the country is found to be varying between 0% in Goa and Tripura, and 68% in Chhattisgarh. There is prevalence of large-scale inequality in food insecurity among various social and religious groups. Around 49% of the households belonging to scheduled tribes are food insecure and the corresponding figure for general category households is 23%. Likewise, around 13% of the Sikh households

are food insecure and the same for religions Hindu is 32.3%.

This paper further identifies the determinants of household level food insecurity. The variables like drought, mean temperature, hill, size of households and dependency ratio increase the probability of food insecurity. Likewise, poverty makes a household more likely to be food insecure. On the other hand, per capita income, remittances and cultivation as the main occupation reduce the probability of food insecurity.

REFERENCES

1. Agarwal, S; Sethi, V; Gupta, P; Jha, M; Agnihotri, A; Nord, M. (2009). Experiential household food insecurity in an urban underserved slum of North India. *Food Security*, *1*(3), 239-250.
2. Brahmanand, P. S; Kumar, A; Ghosh, S; Chowdhury, S. R; Singandhupe, R. B; Singh, R; and Behera, M. S. (2013). Challenges to food security in India. *Current Science*, 841-846.
3. Chakravarty, S; Dand, S. A. (2005). Food insecurity in India: causes and dimensions. *Agreko*,48(4).
4. Dev, S. M; Sharma, A. N. (2010). Food security in India: Performance, challenges and policies.
5. FAO. (2009). The State of Food Insecurity in the World. Food and Agriculture Organization of the United Nations. Rome.
6. Ittyerah, A. C. (2013). Food security in India: issues and suggestions for effectiveness. In *Theme paper for the 57th Members' Annual Conference, Indian Institute of Public Administration, New Delhi*.
7. Jaswal, Sultan Singh. (2014). Challenges to Food Security in India. *IOSR Journal of Humanities and Social Science,* 19(4), 93-100.
8. Kattumuri, R. (2011). Food security and the targeted public distribution system in India.
9. Mukherjee, Protap. (2016). Levels, Patterns and Determinants of Food Insecurity in Urban India. Downloaded from http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1272506514747/Mukherjee.pdf, Accessed on 18th November 2016,11.51am.
10. Upadhyay, R. P; Palanivel, C. (2011). Challenges in achieving food security in India. *Iranian journal of public health*, *40*(4), 31.