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IS THERE A SPATIAL EQUITY IN THE PUBLIC DISTRIBUTION SYSTEM? COMPARISON OF SPATIAL-TEMPORAL PATTERN OF STAPLE CONSUMPTION FROM THE PDS TO STAPLE PRODUCTION

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Abstract

The paper compares the consumption of staple grains from various sources at the household level to the production of staples to examine whether the PDS is consumed in the regions that show a deficit production of staple grains. It is observed that the PDS has fulfilled the spatial equity requirement for most parts of India, especially in the drought year of 2009. Results show that the PDS is important for non-food producing households and regions that do not produce staple grains. However, there is a scope for spatial equity in the PDS, as there are areas with a low consumption from the PDS despite a low consumption of own production of staple grains. This inequity is visible in the regions that traditionally consumed coarse grains and were discontinued from the PDS. The study notes that the demand for fine staples from the PDS relates to the regional nature of traditionally consumed foodgrains.

Keywords: Public Distribution System, Spatial-Equity, Staple Grains Consumption, Calorie Consumption.

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Introduction

The Public Distribution System in India has been designed with the objective of attaining equity in foodgrain distribution by providing access to cheap foodgrains to Indian households. Apart from the direct intervention by subsidising the grain prices, the PDS has other indirect welfare implications by saving household income (Himanshu & Sen, 2013). The equity objective of foodgrain distribution scheme is necessary due to the economic processes that result in large-scale inequality in food consumption (Ramaswami, 2002). The PDS has evolved into a programme meant to distribute foodgrains fairly. It is designed to be equitable by insuring poor consumers against food price fluctuations and providing foodgrain to households which cannot access food security. Nevertheless, the system has several criticisms – from targeting errors and leakages (Khera, 2011; Swaminathan, 2001) to inaccessibility due to strict biometric-based targeting (Dreze, 2017).

In the context of mixed results on the outreach and effectiveness of the PDS, this paper attempts to analyse the spatial equity of Public Distribution System. By spatial equity, we simply mean whether the PDS is consumed in the regions that show deficit production of staple grains. A household may obtain food from three major sources – market, homegrown stock and the PDS (Rahman, 2014). A food market intervention is particularly needed in regions with no access to their own production or low foodgrains production. Recent studies reiterate the link between dietary diversity of rural households with dietary diversity of locally produced food as well as available food in the local markets (Nandi & Nedumaran, 2022). To observe the spatial equity, we analyse the regional calorie production patterns and compare them with the regional pattern of calorie consumption from the PDS (See Table 1). The regions that neither have the insurance of own production nor the security of the PDS are identified as the least food secure.

Rationale of Studying Spatial Equity: Problems in Intervention Scheme

The rationale for discussing spatial equity lies in the spatial variation of two main aspects of food security: a) Production and b) Distribution. Foodgrain production is spatially or regionally concentrated. The responsiveness to food subsidy, therefore, also varies across regions. The food policy of India contributes to this spatial concentration of production by providing producer subsidy through procurement of selected foodgrains using a Minimum Support Price. This price is decided at the beginning of the season, whereas the supply of produce determines open market prices at the end of the season. These "price expectations" result in a cyclical increase in the production of these selected crops (Ramaswami, 2002). The problem is that this procurement of foodgrains in India is heavily biased towards wheat and rice, and that too from a few large producer States (Table 2). Some regions are favoured,e.g. Andhra Pradesh gets free electricity for farmers, and they mainly produce rice. (Chand, 2005; Raghavan, 2004; Chatterjee, 2015).

Regional bias adversely affects farmers in non-food producing regions or small landholders (Rakshit, 2003; De Janvry, 2009; Sundaram, 2015). These farmers are net consumers of foodgrain and do not produce enough to stock and consume in future. Many of these farmers do not even produce rice or wheat secured by MSP, as they are from regions that do not grow food crops. One of the major equity objectives of the PDS is to protect the net food consumers from this regional concentration of food availability.

The second aspect, i.e., distribution of foodgrain too, is heavily unequal across regions for reasons that can best be understood if a spatial analysis is undertaken. The efficiency of distribution system and identification of beneficiaries widely vary between regions. For example, the regions which showed a greater leakage from the PDS in 2011 (see Khera, 2011) were, in fact, the good producers of wheat and mostly well irrigated. The fact that food-producing regions should demand lesser food intervention than non-food producing regions may sound obvious, but it is not. Regional level demands for food security result from many economic and

governance-related factors that the households cannot influence. Previous studies have observed that the benefit of subsidised grain is, in fact, more for producer households (Kaul, 2014). Therefore, it is interesting to observe the pattern of regional concentration of production and regional concentration of distribution to identify the regions where the spatial equity objective of the PDS is not fulfilled.

Data and Methodology

The study used data from Consumer Expenditure Survey of NSSO 2004, 2009 and 2011 for pre-National Food Security Act (NFSA) per capita calorie intake estimations. For the post-NFSA estimations, foodgrain allocation, offtake, and procurement data from the 2022 Foodgrain Bulletin (Govt. of India) has been used along with projected population figures from the Ministry of Jal Shakti, Jal Jeevan Mission website (2022). For the domestic production data, Area-Production-Yield (APY) records have been taken from DACNET, Government of India.

We try to identify the regions where maximum foodgrain production and maximum consumption of subsidised foodgrain are concentrated. If the food security system is equitable towards all the regions, then these two spaces, i.e., regions of maximum production and regions of maximum consumption for the PDS, would be opposite. For a comparative regional analysis, we shall define crop production regions based on per capita calorie production from crops. The details of the indicators are given in Table 1.

Table 1

Construction of Indicators Used in the Study

S. No.	Key Indicators	Description	Data	Construction
Pre-NFSA Estimates				
1	Production of Food	Calorie (Kcal) produced from staple grains (rice+wheat) as % to total calories production for each district	Areas, Production and yield data of Agricultural Census [2004 and 2009], DACNET[1], Govt. of India	Quantity (KG) produced per crop is converted using calorie equivalents as per NSSO standards. Per capita value is worked out from population distribution interpolating by compound annual growth rate between Census 2001 and 2011.
2	Access to Own Production: % from Homegrown sources	Calorie (Kcal) consumed from homegrown staple grains (rice+wheat) as % to total Calories consumed in a month in a household	NSSO large rounds of Consumption Expenditure Survey 2004, 2009, 2011	Quantity is converted to calorie per capita/day using NSSO published conversion rates.
3	Access to PDS	Calorie (Kcal) consumed from PDS (rice+wheat) as % to total Calories consumed in a month in a household	NSSO large rounds of Consumption Expenditure Survey 2004, 2009, 2011	Quantity is converted to calorie per capita/day using NSSO published conversion rates.
4	Regions	Crop regions demarcated on the % calories produced	Using indicator No. 1	Districts are grouped into regions and labelled as per the crop with the largest calorie share
5	Socio-economic controls	a. Social Group b. Land-size class c. Status of Irrigation d. Log of Value of Transfer from the PDS	NSSO large rounds of 2004, 2009. Districts grouped by Dacnet, Govt. of India data	a. Caste groups (SC/ST/OBC/ Others) b. Four quartiles of land-possessed c. Two categories of irrigation status (rainfed/Irrigated)

Contd...

S. No.	Key Indicators	Description	Data	Construction
Post NFSA Estimates				
6	Calories from net production per capita	a. Total quantity of rice/wheat produced up to June – total quantity of rice/ wheat procured last quarter b. Population projections from Jal Jeevan Mission Website Ministry of Jal Shakti, Gov. of India.	a. DACNET, Gov. of India data for APY data b. Foodgrain Bulletin for procurement data and population	Net production is assumed to have association with quantity stored and consumed by households out of their own production- therefore act as a proxy of own-production source of calorie.
7	Per capita calorie consumption	Quantity offtake from PDS converted to Calorie (Kcal) consumed from TPDS (rice or wheat) as % to total projected Calorie consumed in a day per capita	Foodgrain Bulletin data 2022 (up to June)	a. Offtake divided by accepted TPDS beneficiaries by State for per capita value. b. CAGR of calories from two last large rounds in 2004 and 2011 used to predict average total calorie intake for percentage calculation.

Source: By authors.

The study uses descriptive and associative quantitative analysis to comment on the spatial equity conditions of TPDS in India.

To measure the associations of TPDS and production, a simple linear regression of calories from the PDS on calorie produced controlling for selected socio-economic controls is undertaken to work out the partial correlation between PDS consumption and calorie production.

SHM = α + β PRS + β (regions, socio-economic controls) …… (Equation 1)

SPD = α + β PRS + β (regions, socio-economic controls) …… (Equation 2)

Where,

PRS = % Share of calories produced from Rice/ Wheat to total calories produced in the region

SPD = % Share of PDS in total calorie consumption in Households

SHM = % Share of Homegrown stock in total calorie consumption in Households

Instead of looking at a regional distribution of quantities of foodgrains produced, we look at their calorie equivalents as it is a direct measure of food supply. We take both production of calories from and consumption out of homegrown stock to observe the patterns of calorie supply and the extent of demand fulfilled from households' production. We compare these patterns with demands for the PDS to observe how and where the PDS is fulfilling the gap between food supply and demand.

Choropleth mapping is used to identify the regional distribution of the percentage of calories produced from staples (rice and wheat) and coarse grains (pulses, millets, etc.), percentage of calories consumed out of homegrown stock for staples and coarse grains, and percentage of calorie consumed out of the PDS for staples (rice and wheat).

We have done the mapping analysis for 2004 and 2009. In 2004, the first large NSSO round of consumption after targeting was implemented, whereas 2009 was a drought year. It is interesting to observe the distribution and spatial co-variation

patterns of these three variables (production, consumption from home and the PDS) in both years.

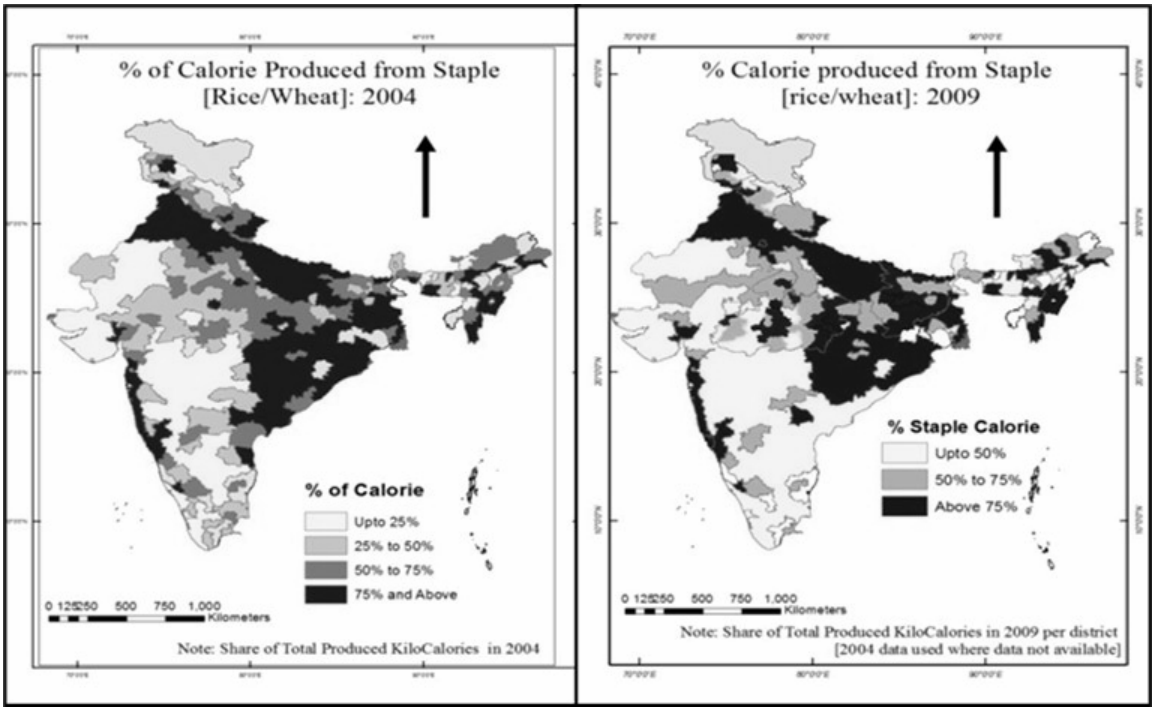
To arrive at the post-NFSA per-capita figure, the projected rural population has been used with domestic rice and wheat production data for 2021, and the number of accepted beneficiaries in NFSA 2021-22 has been used with offtake and procurement (2021-mid-2022). The per capita offtake and procurement have been converted to kilocalorie using the calorie conversion rate from NSSO 2011 report. Last year's per capita domestic calorie production against the net of calorie procurement in the current year has been used as a proxy of homegrown stock per capita.

Results and Discussion

Spatial-temporal pattern of calorie production from staple grains pre-NFSA: We first look at the regional pattern of production of fine staples, i.e. rice and wheat. Production of calories from rice and wheat in 2004 is heavily concentrated in the well-irrigated Indo-Gangetic northern India, parts of western coastal India in Maharashtra, Goa and a few districts of Karnataka, Odisha and Andhra Pradesh in southern India. Although acreage-wise, the distribution may differ in share to total calorie production, Tamil Nadu (32 per cent of total cropped area under paddy in 2004 and 33 per cent in 2009) or Kerala do not figure in the staple producing regions. In 2009, the span of areas where rice and wheat contribute more than 75 per cent of the total calorie produced shrunk. The details are presented in Figure 1.

Figure 1

Percentage of Calorie Domestic Production: Rice+Wheat 2004 & 2009

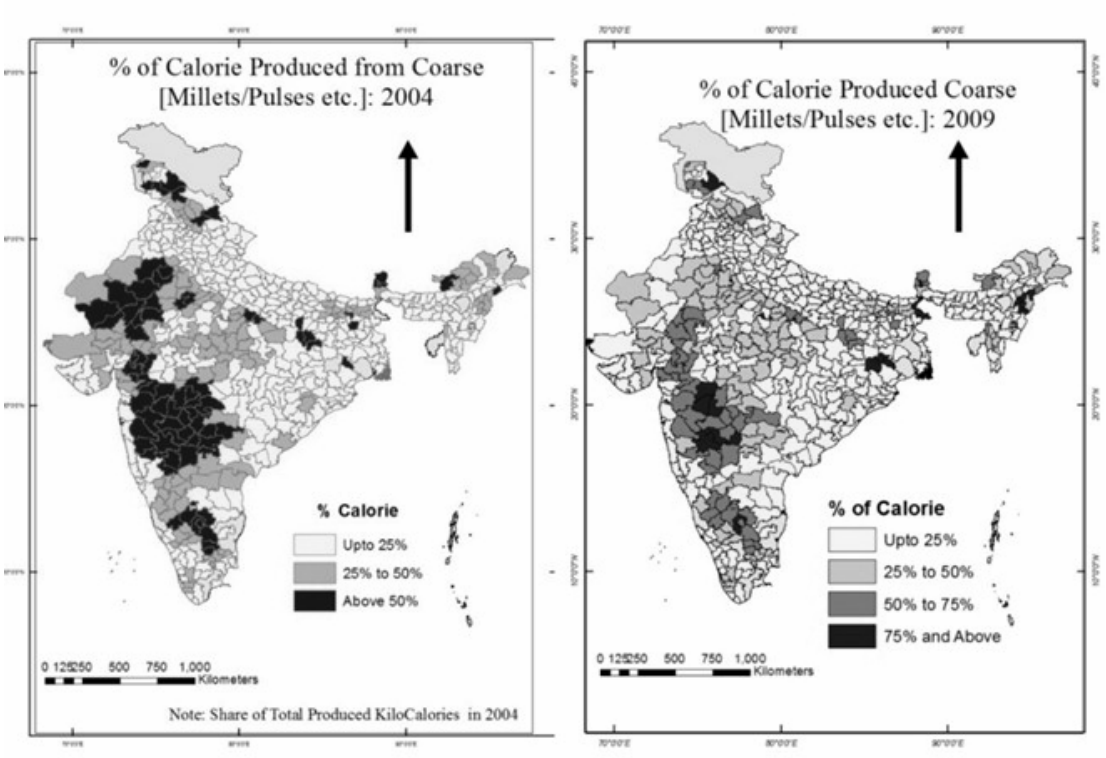


Source: Bhattacharya, 2016.

From the distribution of coarse grains in 2004, it is observed that in the unirrigated parts of India, such as Rajasthan, Gujarat and parts of Maharashtra, coarse grains and pulses are the major crops. The region producing coarse grains shrunk in 2009 (Figure 2). Overall, the share of production of coarse grains is negligible and highly concentrated in west-central parts of India.

Figure 2

Percentage of Calorie Domestic Production: Coarse Grains 2004 & 2009



Source: Bhattacharya, 2016.

2009 was a drought year, which may be one of the reasons. The regions, which discontinue rice and wheat having a major share in total calorie production, are in the rainfed southern parts and arid & semi-arid western parts of the country. This shift towards rice-wheat may also be the result of producers systematically turning towards grains, which are protected by minimum support prices. After 1997, coarse grains were discontinued from the PDS, and the procurement stopped. The preference for rice and wheat on the production side adversely affected the traditional foodgrains such as pearl millets, etc., in the arid and semi-arid regions (Nagaraj et al., 2013).

Although the real minimum support prices increased for all crops, it did not hold much meaning for coarse grains producers as related procurement of coarse grains was negligible. Trends of foodgrain procurement by Food Corporation of India for 2004 and 2009 (Table 2) show that rice and wheat are the main crops that are procured. These States comprise less than half of the coarse grains or cotton-producing regions, which are dry and traditionally grow coarse grains and millets. Procurement of only selected foodgrains such as wheat reinforces the distortions in their production and sales (Chand, 2005; Editorial, EPW, 2015).

Table 2

State-wise Procurement of Foodgrains (Lakh Tonnes) in 2004 and 2009

State/UT	Bajra		Jowar		Maise		Ragi		Rice		Wheat	
	2004	2009	2004	2009	2004	2009	2004	2009	2004	2009	2004	2009
Andhra Pradesh					1.9	0.1			39.1	75.6		
Assam										0.1		
Bihar									3.4	8.9	neg.	1.8
Chandigarh					0.1	neg.			0.2	0.1		0.1
Chhattisgarh									28.4	33.6		
Delhi											neg.	0.1
Goa												
Gujarat												neg.
Haryana	1.3					0.8			16.6	18.2	45.3	63.4
Himachal Pradesh									neg.			neg.
Jammu & Kashmir												
Jharkhand									neg.	0.2		neg.
Karnataka					3.8	3.2	0.5	neg.	0.2	0.9		
Kerala									0.3	2.6		
Madhya Pradesh	neg.	neg.			neg.	neg.			0.4	2.6	4.8	35.4
Maharashtra	neg.	neg.	0.1	neg.	0.1	0.1			2.1	2.3		
Nagaland									0.1			
Odisha									15.9	25.0		
Punjab					neg.				91.1	92.8	90.1	102.1
Rajasthan									0.2		1.6	4.8
Tamil Nadu									6.5	12.4		
Uttar Pradesh									29.7	29.0	5.6	16.7
Uttaranchal									3.2	3.8	0.4	0.9
West Bengal									9.4	12.4		0.1

Source: Collated from FCI, Govt. of India

Note: neg. refers to negligible amount or procurement less than 0.09 lakh tonnes.

Consumption from Homegrown Sources pre-NFSA: We observe the percentage of fine and coarse staples consumed out of own production, and found that the regional pattern of rice and wheat production has a positive association with the pattern of access to own grown production (Table 3). Controlling for socio-economic factors and regions, the production share of staple grains shows a very low but statistically significant positive effect (B 2004: 0.0004,2009: 0.0001; $p<0.0001$) on the percentage of consumption from homegrown stock.

Table 3

Association between percentage consumed from Home and percentage of Calorie from Rice/Wheat Production 2004 & 2009

Indicators	2004 B Coef.	[95% Conf. interval]		2009 B Coef.	[95% Conf. Interval]	
		Lower	Upper		Lower	Upper
% of Kcal from Rice	0.0004	0.000	0.000	0.0001	0.000	0.000
Caste						
ST	Reference					
SC	-0.041	-0.050	-0.032	-0.028	-0.035	-0.021
OBC	-0.027	-0.036	-0.019	-0.025	-0.031	-0.019
Others	-0.024	-0.034	-0.014	0.005	-0.002	0.012
Land Class						
Quartile 1	Reference					
Quartile 2	0.115	0.102	0.127	0.070	0.060	0.080
Quartile 3	0.143	0.124	0.163	0.109	0.093	0.125
Quartile 4	0.168	0.095	0.240	0.122	0.084	0.159
Irrigation Dummy	-0.024	-0.030	-0.018	0.001	-0.004	0.006
Log of Amount of Subsidy	-0.024	-0.026	-0.021	-0.035	-0.038	-0.033
HH Type						
Non-Agricultural Labour	Reference					
Agricultural Labour	-0.001	-0.007	0.005	-0.013	-0.019	-0.007
Cultivator	0.177	0.170	0.185	0.171	0.166	0.177
Constant	0.142	0.130	0.153	0.223	0.213	0.234

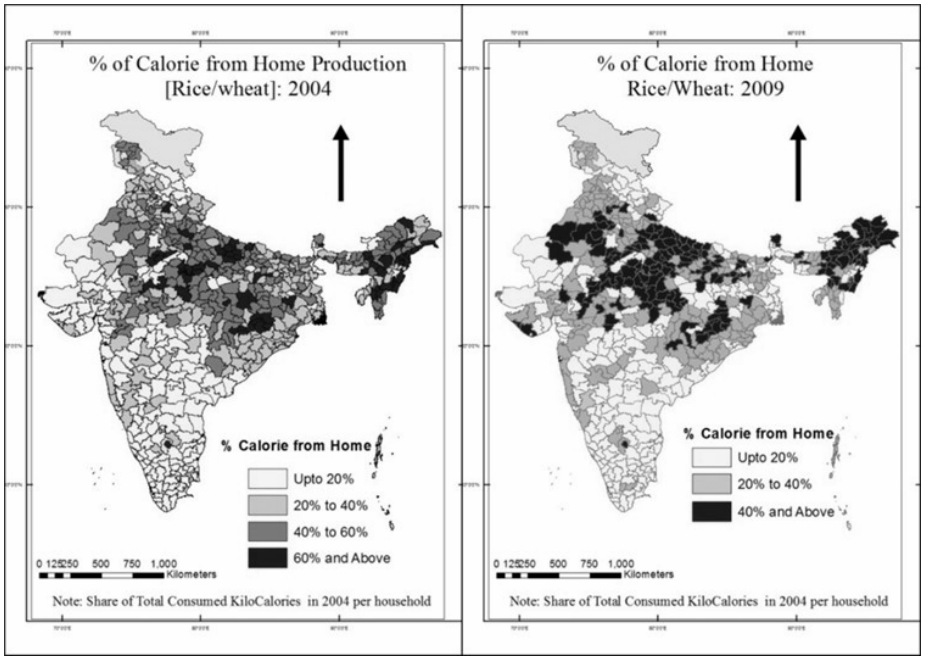
Source: By authors using NSSO 2004 and 2009 CES.

The maps show that the regions where rice and wheat have a major share in production also consume a larger share of rice and wheat from their own produced stock (Figure 3). For coarse grains and pulses, home production is a major source in most parts, especially the arid regions (Figure 4). In 2009, which was a drought year, the dependence on own production declined.

However, this association is very broad, and one must not overlook the other complexities. A similar relation in the case of foodgrains that are not procured (e.g. pulse and millet) assigns some validity in establishing such a relation between the production of foodgrains and consumption out of own produce.

Figure 3

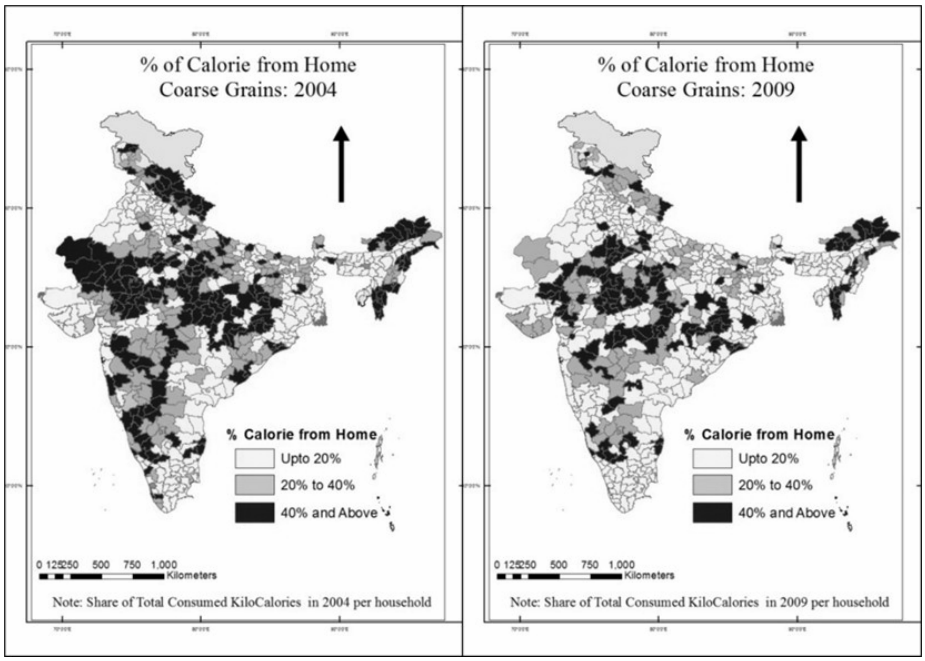
Percentage of Calorie from Own Home Production: Rice+Wheat 2009



Source: Bhattacharya 2016.

Figure 4

Percentage of Calorie from Own Home Production: Coarse Grains 2004

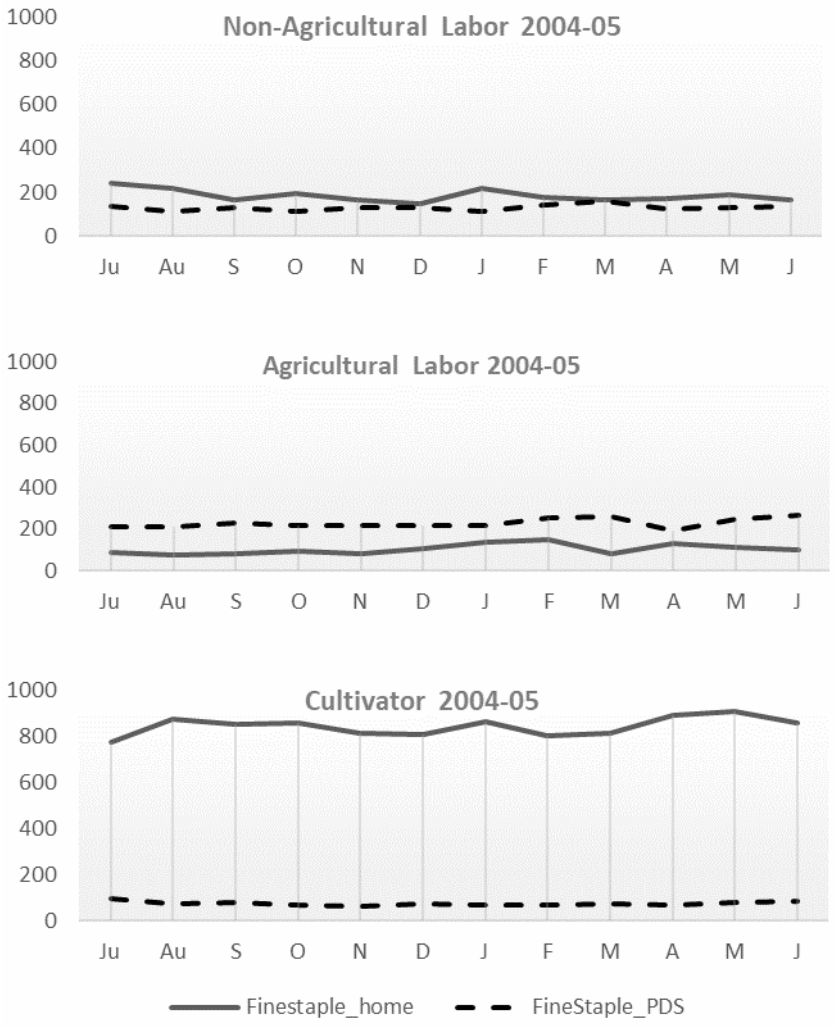


Source: Bhattacharya 2016.

Spatial-temporal pattern of consumption of staple grains from the PDS pre-NFSA: In 2004-05, it was observed that in contrast to the non-agricultural labourers who availed PDS when the homegrown stock was low, the Kilocalories from fine staples that the agricultural labour households were availing from the PDS was higher than what they availed from homegrown stock throughout the year. The calorie intake from homegrown stock and the PDS showed an exact opposite trend in all months, but the Kilocalories consumed from PDS were higher than homegrown stock for the agricultural labour households. For cultivator households still, PDS is in low demand throughout the year (Figure 5).

Figure 5

Monthly Calorie Intake from Sources 2004-05

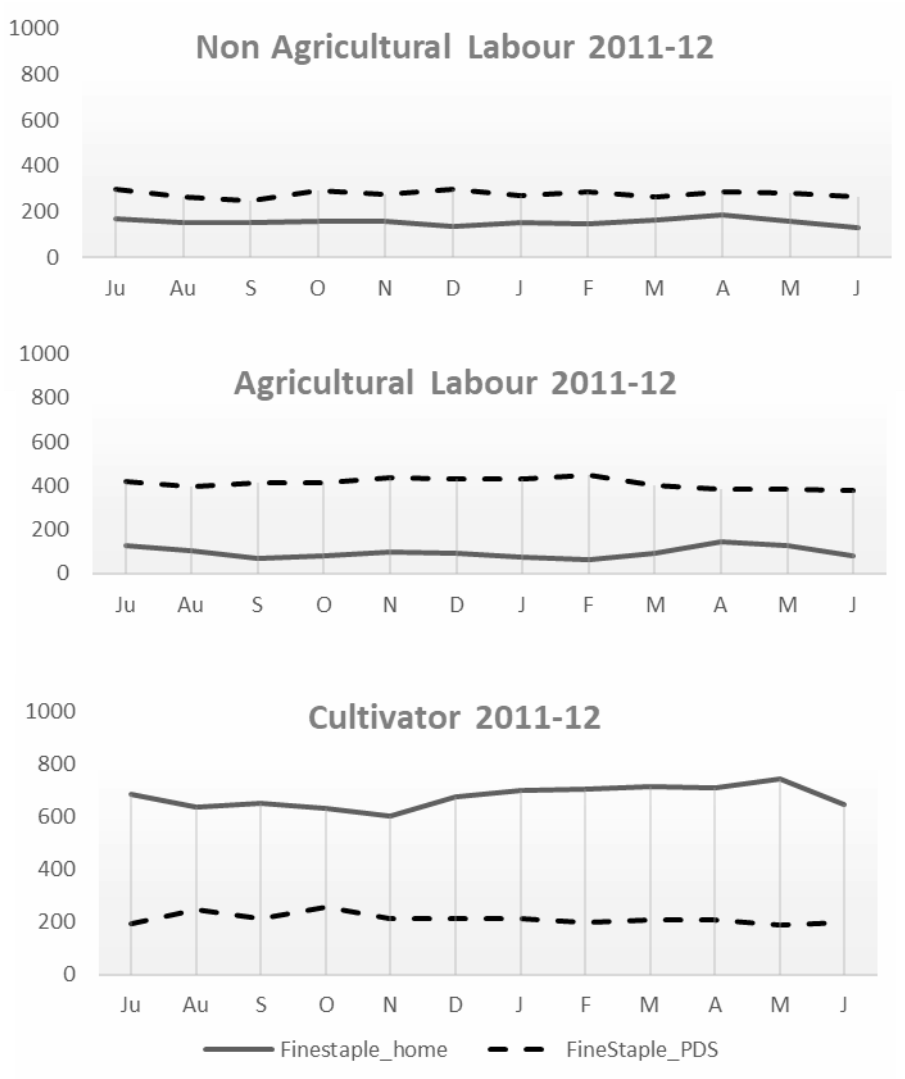


Source: Bhattacharya, 2018 (Using NSS CES 2004).

We further extend the analysis to 2011-12, which is the later year of targeted PDS, and by this year, multiple State level reforms in PDS were in effect (Figure 6). We observe that all the labour households in 2011-12 – agricultural or non-agricultural – were consuming a greater amount of calories from PDS than from homegrown stock. When homegrown stock consumption showed an increase in the peak season, the consumption from PDS declined. But again, in lean seasons, calorie intake from PDS went up for the labour households. This reversal of consumption levels from homegrown stock and PDS could be a result of better targeting in later years when the low-income labour households could access PDS in lean seasons and further lowering of consumption out of own production as wages monetised and landlessness increased.

Figure 6

Monthly Calorie Intake from Sources 2011-12



Source: Bhattacharya, 2018 (Using NSS CES 2011).

We finally look at the regional pattern of the demand for food security intervention, i.e., consumption out of the PDS, and compare it with the regional distribution of production (consumption out of own produce) of calories. The simple linear regression shows a negative association (B 2004: -0.091; 2009: -0.090, p<0.0001) between the percentage consumed from the PDS and the share of calories produced from staples controlling for selected socio-economic indicators (Table 4).

Table 4

Association between percentage consumed from the PDS and percentage of Calorie from Rice/Wheat Production 2004 & 2009

Indicators	2004	[95% Conf.		2009	[95% Conf.	
	B	Lower	Upper	B	Lower	Upper
% From home	-0.091	-0.105	-0.078	-0.090	-0.101	-0.080
% Of Kcal from Rice	0.000	0.000	0.000	0.000	0.000	0.000
Caste						
ST	Reference			Reference		
SC	-0.019	-0.026	-0.012	-0.049	-0.055	-0.044
OBC	-0.027	-0.034	-0.021	-0.061	-0.066	-0.056
Others	-0.052	-0.060	-0.045	-0.078	-0.084	-0.073
Land Class						
Quartile 1	Reference					
Quartile 2	-0.029	-0.038	-0.019	-0.030	-0.038	-0.021
Quartile 3	-0.039	-0.055	-0.023	-0.046	-0.058	-0.033
Quartile 4	-0.073	-0.130	-0.015	-0.043	-0.072	-0.013
Irrigated	-0.005	-0.010	-0.001	0.003	-0.001	0.006
Log of Amount of Subsidy	0.044	0.042	0.046	0.050	0.048	0.052
HH Type						
Non-Agricultural Labour						
Agricultural Labour	0.010	0.005	0.015	0.017	0.012	0.022
Cultivator	0.004	-0.003	0.010	0.008	0.003	0.013
Constant	0.174	0.165	0.184	0.146	0.138	0.155

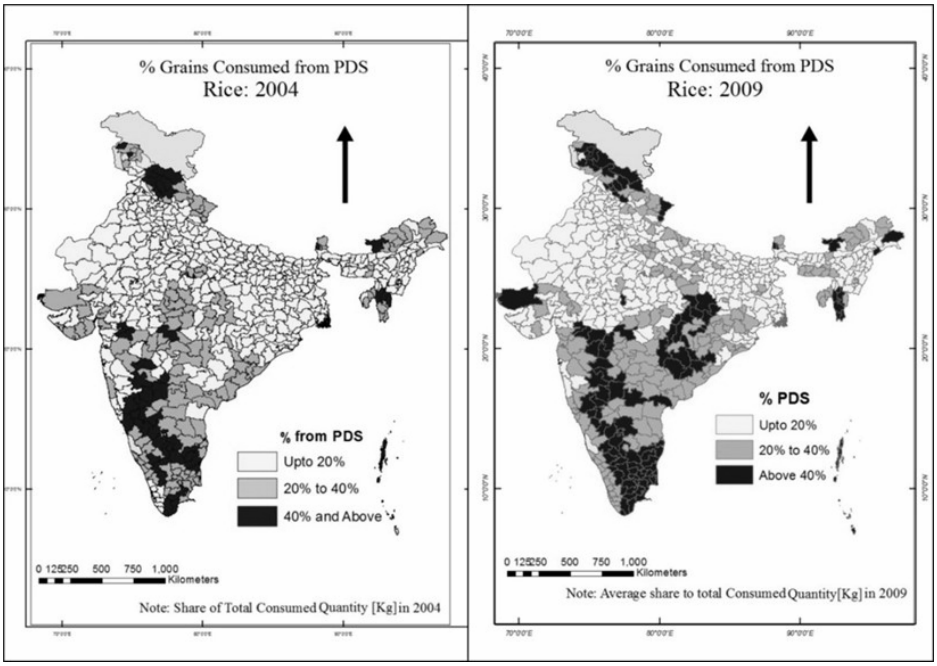
Source: By authors using NSSO 2004 and 2009 CES.

The maps showing the distribution of consumption from the PDS reveal a shift in the composition and extent of foodgrains consumed out of the PDS. There were several regions where the percentage consumed from the PDS was high and the percentage of consumption from household's own production was also low. It seems that for a large part of India, the PDS did achieve spatial equity.

In 2004 and 2009, regions that showed greater dependence on the PDS were in the rainfed southern part of the country. Almost all South India, Chhattisgarh, Odisha and Kutch of Gujarat in Western India consumed above 20 per cent of rice from the PDS by 2009 (Figure 7). The region consuming above 20 per cent of wheat from the PDS shrunk to parts of Karnataka in 2004, but again in the drought year, when its produce was unavailable, it extended to Tamil Nadu (Figure 8). Other than the drought-led increase in the percentage of consumed from the PDS, studies at the ground level identify governance and local policy improvisations as possible reasons behind the increased demand for PDS grains in 2009 (Khera, 2011; Krishnamurthy et al., 2014). Other than examples of Tamil Nadu, which provided rice nearly free of cost, Chhattisgarh increased the coverage of the PDS and improved governance. Drought may have also lowered the access to other sources of foodgrains in 2009.

Figure 7

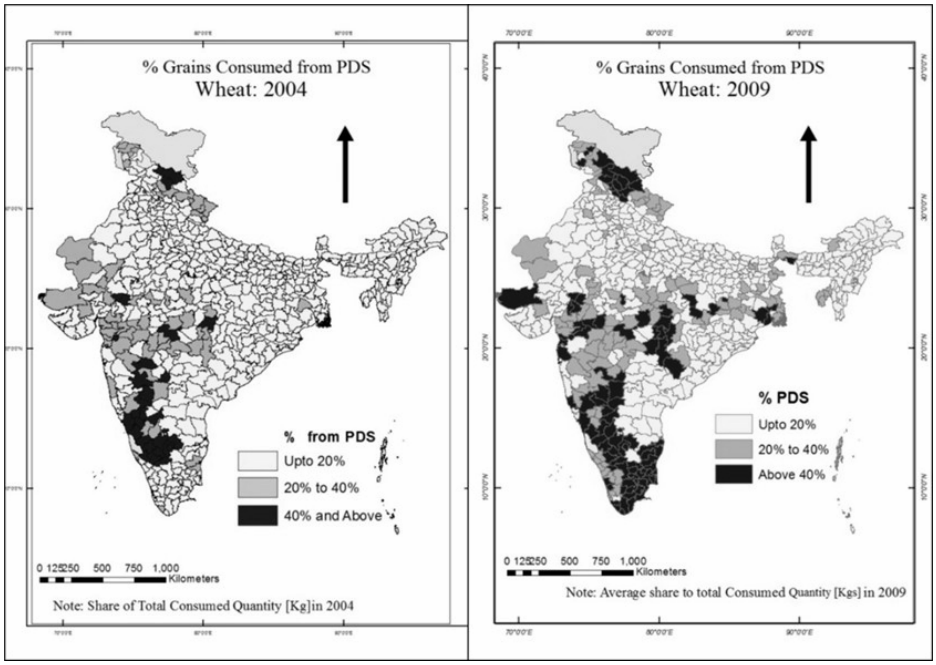
Percentage of Rice Consumed from PDS



Source: Bhattacharya 2016.

Figure 8

Percentage of Wheat Consumed from PDS: 2004



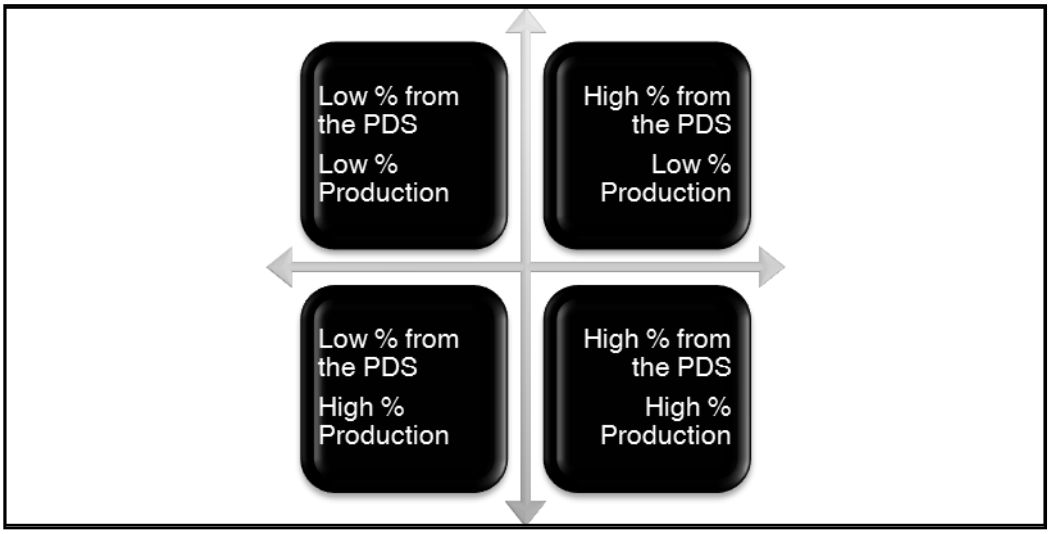
Source: Bhattacharya 2016.

Identifying the Regions of Inequity in Distribution System

We superimpose the distribution of production of foodgrains over the distribution of consumption out of the PDS and identify four regions.

Figure 9

Schematic Presentation of the Regions Juxtaposing Percentage Consumed from the PDS and Own Production



Source: By authors.

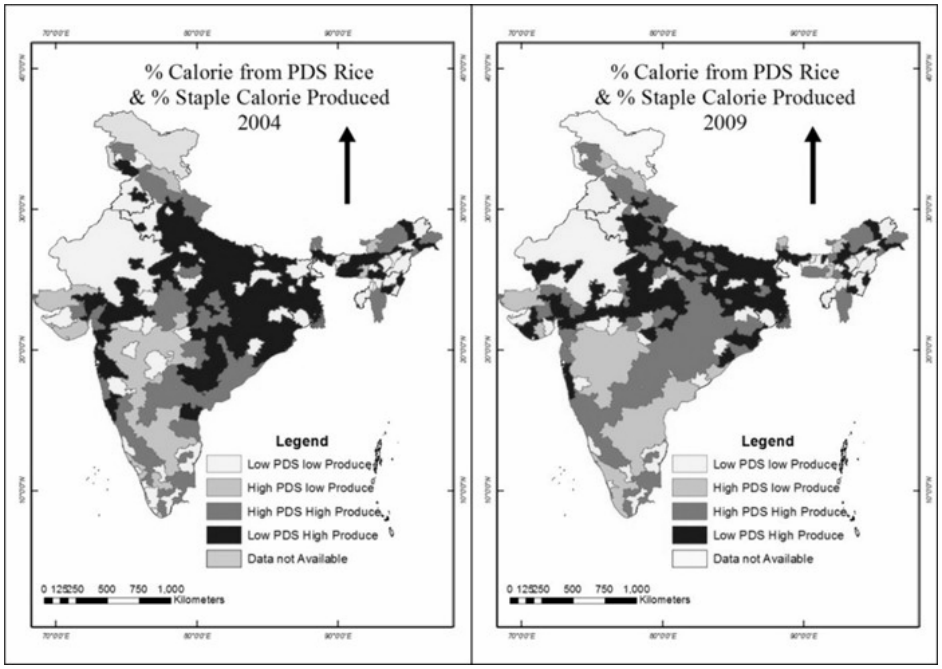
- First, where proportions of both production and the PDS are low (Top left)
- Second, where own production is low, but access to the PDS is high (Top Right)
- Third, where own production is high, but demand for the PDS is low (Bottom Left)
- Fourth, where both access to own produce is high (Bottom right)

In the regions that fall in the top left quadrant (Figure 9), where proportions of both production and the PDS are low, PDS has not achieved spatial equity.

For rice in 2004, the arid and the semi-arid regions in Rajasthan and parts of Maharashtra where rice is not consumed, fall in the top left quadrant (Figure 10). Apart from these regions, a few districts in northeastern and eastern India also show low access to the PDS despite having lower access to own production. In 2009, the drought year, the regions with greater dependence on the PDS extended even to the areas with good production (Figure 10).

Figure 10

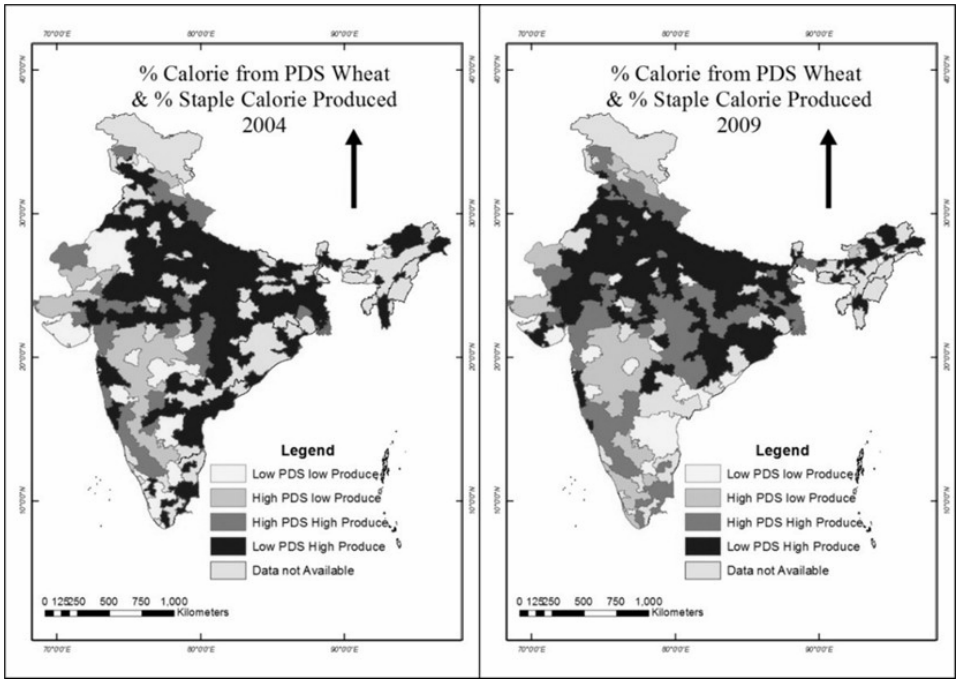
Percentage of Calorie Produced vs Percentage of Calorie Consumed from the PDS: Rice



Source: Bhattacharya 2016.

Figure 11

Percentage of Calorie Produced vs Percentage of Calorie Consumed from the PDS: Wheat



Source: Bhattacharya 2016.

In the case of wheat, in 2004, only the districts in central arid parts of India showed a higher dependence on the PDS with or without produce (Figure 11). There are many districts without information, but parts of Maharashtra, Rajasthan and Gujarat fall into regions where the PDS is low even when access to own produce is low. The reason behind a low demand for the PDS may be many, as several studies suggest. Jha et al. (2013) observe that Andhra Pradesh had a lower share of the PDS rice even when the programme efficiency was better than Rajasthan. Andhra Pradesh also is a major producer of rice.

Having access to food production has a negative association with consumption from the PDS. However, in States like Rajasthan and many other parts of India, the PDS suffers from several functional defects which hamper its demand despite the lack of foodgrain availability, as has been pointed out by many scholars (Ramaswami, 2002; Khera 2011; Masiero & Prakash, 2015). Even in places where the computerisation of beneficiary list has taken place, there is tampering with the entries. Here, issues like corruption (Masiero & Prakash, 2015), and higher price of grains prevail (Rakshit, 2003).

A poorer PDS in the non-food producing rainfed districts also points to the demand-side bottleneck. These regions have had different local consumption patterns as the main staple here were coarse grains, i.e. millets, bajra, jowar, etc. The PDS does not include these grains since 1997 and supplied rice and wheat instead. Large parts of the regions where wheat is primarily distributed in the PDS are traditional consumers of coarse grains; they show a lower consumption from the PDS than the regions where rice is primarily distributed. One of the reasons may be the non-distribution of traditionally consumed grains in those regions.

Estimating the Welfare Gain from the PDS Transfer: Himanshu and Sen (2013) argue that apart from the direct benefit of providing cheap foodgrains, the PDS indirectly benefits households by saving their income. The regional difference in demand and supply of foodgrains motivates us to observe the magnitude of benefit received by the households from the PDS.

Adopting the method of Himanshu and Sen (2013), we add the value of transfer from the PDS (quantity demanded multiplied by the value of discount) to the MPCE of households and observe the change in the regional estimates of the poverty headcount ratio. We performed this exercise for 2011 rural India using the NSS CES, 2011.

Table 5

Head Count Ratio 2011 using MPCE and Transfer Adjusted MPCE

Irrigation	Regions	HCR	HCR adding transfer
Irrigated	Pulse/Coarse	20.2	19.7
	Non-grain	9.8	7.6
	Partly staple	20.5	18.1
	Rice	20.3	17.0
	Wheat	26.9	26.1
	Non-food	26.1	22.5
Rainfed	Pulse/Coarse	18.6	17.6
	Non-grain	21.8	19.8
	Partly staple	26.2	24.3
	Rice	31.7	27.1
	Wheat	38.8	37.3
	Total	25.4	23.1

Source: Computed by authors using NSS CES 2011
Note: For region creation, refer Bhattacharya 2016.

Except for the irrigated wheat and coarse grains producing regions, all others show a notable decline in poverty ratio using a transfer adjusted MPCE (Table 5). These regions will lose more if the PDS is discontinued. The biggest drop in headcount is observed in the rainfed rice-growing regions and regions that do not produce food crops. The benefit of transfer may accrue to poor households of any region, but the magnitude of indirect benefit is more in the regions, which are otherwise vulnerable to food crisis or insecurity.

Estimating the Spatial Pattern of Welfare Loss from discontinuation of Coarse Grains

Using an indirect method, we tried to estimate the welfare impact of discontinuing the coarse grains from the PDS using the NSS data of 2011. We estimated the value of transfer[2] from the grains that were discontinued after 1997. We added this amount to the monthly per capita expenditure and computed the region-wise poverty headcount ratio (HCR) using State-specific poverty lines of the Planning Commission and compared them with existing HCR (Table 6).

Table 6

Head Count Ratio 2011 using MPCE and Transfer adjusted MPCE (half of MSP and Farm retail price as THE PDS price)

Irrigation	Regions	HCR	HCR MSP	HCR Farm
Regions by Calorie Production Per Capita				
Irrigated	Non-food	26.1	25.4	25.7
	Non-grain	9.8	8.6	7.8
	partly staple	20.5	18.8	20.4
	Pulse/Coarse	20.2	13.5	16.5
	Rice	20.3	18.0	20.0
	Wheat	26.9	25.7	26.2
Rainfed	Non-grain	21.8	20.9	21.2
	partly staple	26.2	24.7	24.5
	Pulse/Coarse	18.6	16.1	16.4
	Rice	31.7	30.4	31.5
	Wheat	38.8	37.0	38.4

Source: Computed by authors using NSS CES 2011
Note: For region creation, refer Bhattacharya, 2016.

The regions showing the largest decline in poverty, as the transfer from the coarse grains is added, are either rainfed or mainly produce coarse grains (Table 6).

PDS consumption Post NFSA 2013

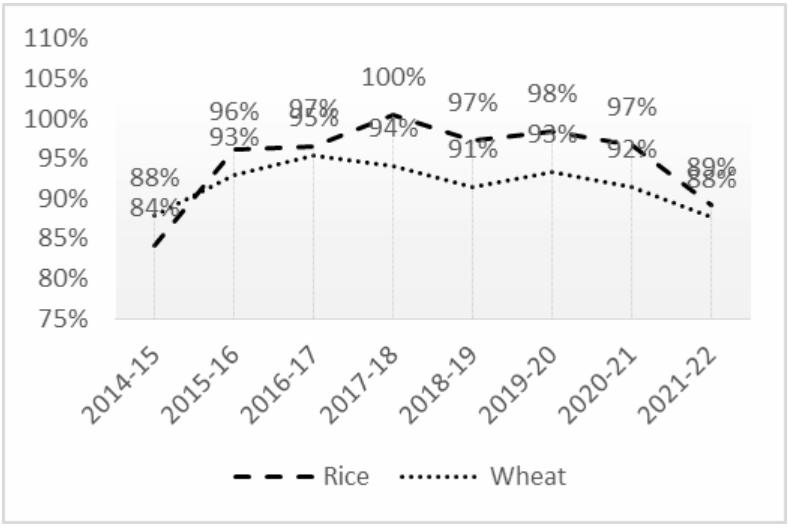
The PDS underwent a major change after 2013 with the NFSA implementation. Unfortunately, extensive surveys of NSSO end before that. However, some data-based evidence is available from other surveys from the Food-grain Bulletins (Consumer Affairs) 2022. Post-2013, NFSA allocations have two components - first is the TPDS State allocations, and second is the tide over allocation, i.e. in the case of a reduction in post-NFSA allocation, a Centrally sponsored matching allocation up to the pre-reduction average levels.

Looking at the trends of offtake to allocation

(Figure 12), it is observed that in the case of rice, the percentage of combined total (tide over + TPDS) offtake to allocation remains high, which points to a higher consumption of PDS in the rice consuming States. This proportion is lower in wheat even during the pandemic years when PDS consumption was higher than average. In fact, the proportion of total offtake of wheat (tide over + TPDS) to only TPDS allocation does not cross 100 per cent (Figure 13).

Figure 12

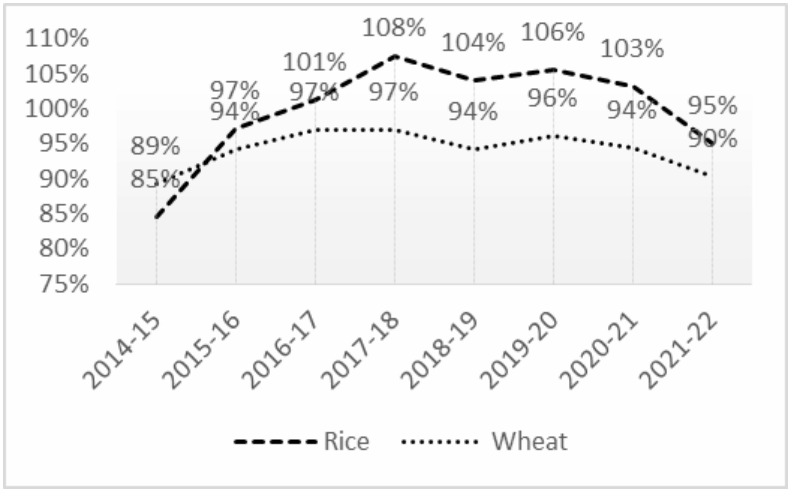
Percentage of Total Offtake to Total Allocation 2014-2022



Source: By authors using data from Foodgrain Bulletin 2022 (FCI).

Figure 13

Total Offtake to Allocation without Tide Over



Source: By authors using data from Foodgrain Bulletin 2022 (FCI).

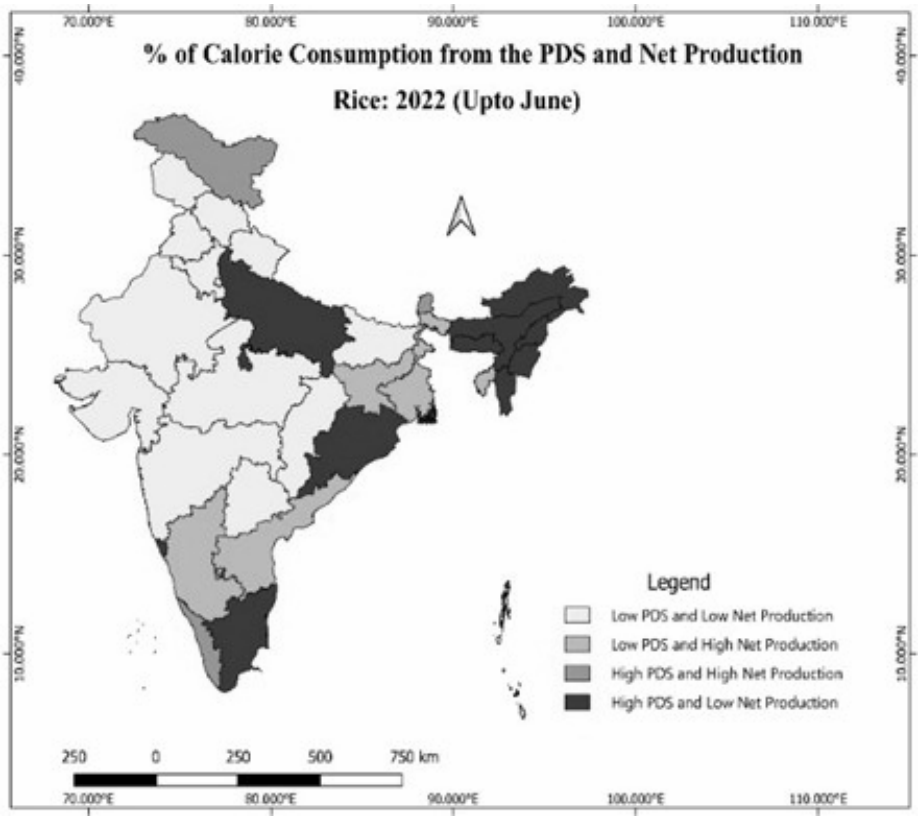
Combining the percentage of calories consumed from the TPDS with the percentage of calories produced net of procurement by State, we roughly recreated the spatial equity maps post-NFSA.

In the case of rice, it is observed that Uttar Pradesh, North-East, Odisha and Tamil Nadu have a high consumption of PDS with low net production (Figure 14). Barring Uttar Pradesh, the rest are culturally rice-eating States. PDS consumption is high despite high production in Kerala. Karnataka, Andhra Pradesh, Jharkhand and West Bengal show a lower calorie consumption from the PDS and have high net production.

However, many western and northern Indian States, such as Maharashtra, Gujarat, Rajasthan, Punjab Haryana, Madhya Pradesh, Bihar, Telangana and Chhattisgarh, show low PDS and low net production – pointing to a spatial inequity.

Figure 14

Percentage of Kilocalorie from Net Production vs Percentage of Calorie from the TPDS Rice: 2022

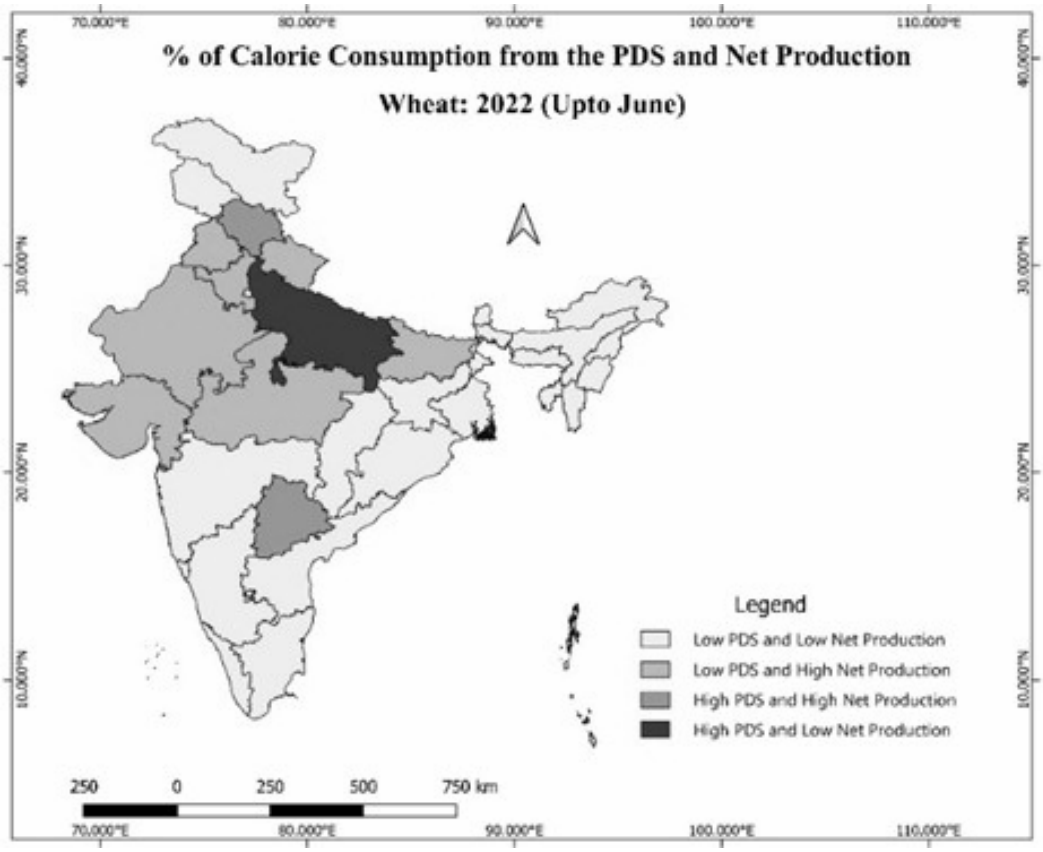


Source: By authors using procurement/offtake data/population estimates from Foodgrain Bulletin 2022 (FCI); Production from DACNET Govt. of India 2021; Calorie conversion values from 2011 NSS report on nutrition

For wheat, inequity is observed in traditionally non-wheat eating States of the southern and northeastern parts of India (Figure 15). The wheat-eating & wheat-producing States show lower dependence on PDS for calories, whereas Uttar Pradesh shows higher consumption of calories from the PDS with low net production.

Figure 15

Percentage of Kilocalorie from Net Production vs Percentage of Calorie from the TPDS Wheat: 2022



Source: By authors using procurement/offtake data/population estimates from Foodgrain Bulletin 2022 (FCI); Production from DACNET Gov. of India 2021; Calorie conversion values from 2011 NSS report on nutrition.

Summary

In this study, we analysed the regional pattern of food production and regional distribution of the PDS and discussed the equity implication of the same. We observe that the PDS has, in fact, fulfilled the spatial equity requirement for most parts of India, especially in the drought year, i.e. 2009. The lack of spatial equity was also observable in the NFSA regime post-pandemic (2022). Some selected areas showed a low consumption of the PDS despite a low production of staple grains. These regions traditionally consumed coarse grains and were discontinued from the PDS.

Our analysis of the monthly consumption trend reinforces that the PDS is still important for non-cultivator households. Dismantling it has no merit as it will hurt a large section of labour households who depend on the PDS in food deficient seasons.

The descriptive analysis points to an association between production and consumption

locally. The system of Public Distribution has not been '*spatially equitable*' in the regions where traditionally consumed grains are not rice and wheat. These regions have lesser access to foodgrains out of their own produce and are the ones which require a foodgrain intervention. This mismatch between the PDS access and food production, i.e. where both production and the PDS are low, is more for wheat than rice. It is observed that in the rainfed regions where coarse grains or non-foodgrain crops are major produce, consumption is the lowest out of the PDS.

The welfare implication of this regional distortion between the source of calories demanded and received is twofold. Firstly, those regions lacking access to food production and poorly performing PDS may be considered extremely food insecure. Secondly, the PDS is not adjusted to regional consumption baskets. The poorer sections of the arid and semi-arid regions have been consuming the coarse grains or inferior grains, which are not distributed through the PDS. Since the distribution is stalled, these grains are hardly procured, thus shifting farmer households towards cash crops or other crops they do not consume. There are other sources to acquire food from, such as direct delivery. However, households have become increasingly dependent on open market for consumption. Cash transfers also push households towards the open market, which may not offer the diverse grains needed for a sufficient diet.

To summarise, we observe that the PDS is important for calories in the non-food producing households and regions, but the consumption of calories from the PDS gets affected by the regional nature of foodgrain production and traditionally consumed foodgrain. In this scenario, the impact of the PDS would be different in various regions. The functioning and welfare impact of this system may improve if it addresses foodgrain requirements with a decentralised design. The study points to the need for a further analysis of spatial impact of the TPDS to identify the regions where the system should be strengthened. In areas where foodgrains are distributed, such an analysis could also help to adjust and diversify the supply.

Author's Contribution:

Dr. Ruchira Bhattacharya: Conceptualization, data curation, analysis and write up

Mr. Joseph Ravi: data visualization, analysis and write up

End Notes

1. Directorate of Economics and Statistics, Department of Agricultural, Cooperation and Farmers' Welfare, Ministry of Agriculture and Farmers' Welfare, Government of India
2. The quantities of Jowar, Bajra, Maize, Arhar, Split Gram, Mung, Masoor, Urad, Khesari and edible oils are given in NSS data. We take 2011's actual Minimum Support Prices (MSP) [CACP, GoI] and convert it to per kg for these crops. We use half of this MSP as PDS price in 2011. In an alternative method we have taken half of the farm retail price [unit value of crops out of home-grown stock] as PDS price.

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