Public Distribution System in India: Implications for Poverty and Food Security

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Abstract

This paper investigates the effect of food subsidy through Public Distribution System (PDS) on poverty and food security in India. The study used fiscal transfer method to estimate the subsidy transfer through PDS and its indirect benefits as a window for the poor to escape poverty and improve food security. The robustness of the results was checked based on propensity score matching (PSM) technique. The study established that, the effectiveness of PDS has improved over time and PDS emerged as an effective tool in targeting the twin problems of poverty and under-nourishment in the country.

Key words: PDS, Poverty, Food security, Nutrition security, India

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Introduction

The enactment of National Food Security Act (NFSA) in August, 2013 in India has renewed the deliberations on food security and consequently, functioning of Public Distribution System (PDS) became one of the intensely debated issues in the country. PDS is one of the most important public intervention programs to enhance food security in India and therefore, the success of NFSA will critically depend upon efficient functioning of PDS. PDS provides rationed amount of basic food items and other non-food items at subsidized prices to consumers through a network of "fair price shops". The coverage and functioning of PDS underwent several changes overtime but it essentially remained an instrument to augment food security. The access to PDS was universal till 1992 (at least in theory). Rampant corruption and high operational costs led to repackaging the program as Revamped Public Distribution System (RPDS) with focus in tribal, arid, hill and remote areas in 1992 and then to a Targeted Public Distribution System (TPDS) in 1997. The aim of the TPDS was to target the poorest households by differentiating the access quantities and prices at which one is allowed to buy. The differentiation was achieved by classifying the beneficiaries into Above Poverty Line (APL), Below Poverty Line (BPL) or Antyodaya households based their economic status, assessed based on the state-specific poverty lines. Antyodaya cards,

which enjoy a larger subsidy than BPL households, are meant for the poorest of the poor.

In spite of the extensive coverage of PDS and its important role in ensuring food security, its relevance and effectiveness in reducing poverty and improving food security has been questioned frequently in policy discourse on food transfers in India. A number of studies related to PDS have pointed out anomalies such as inclusion and exclusion errors (Swaminathan and Misra, 2001; Hirway, 2003; Khera, 2008; Mahamalik and Sahu, 2011), large scale leakages (Jha and Ramaswami, 2010; Himanshu and Sen, 2011; Khera, 2011; Kumar *et al*, 2012; among others) and so on. On the other hand, the role played by PDS in poverty alleviation and improving food security were highlighted in a few other studies (e.g. Radhakrishna *et al*, 1997; Dreze and Khera, 2013; Tritah, 2003, Himanshu and Sen, 2013). This paper is an attempt in similar direction with focus on assessing the impact of PDS on poverty alleviation as well as improving food security of the beneficiaries. The analysis covers temporal as well as spatial dimensions of the transformation that PDS brought about in the country in terms of income gains, poverty reduction and nutritional enhancements that is gauged through a mix of traditional as well as recent advances in methodology.

Data and Methodology

The study is based on the unit level data from 50th (1993-94), 61st (2004-05), 66th (2009-10) and 68th (2011-12) rounds of the Consumption and Expenditure

Survey conducted by the National Sample Survey Organization (NSSO), of the government of India (GoI). Each survey contains detailed information on values and quantities of household consumption along with other household specific information. The Planning Commission, GOI relies on these surveys to estimate poverty lines on a regular basis. The household data were used to compute the average per capita consumption expenditure. The calorie intake was computed by using the nutrient charts provided by the NSSO for each commodity (NSSO, 2012). The questionnaires used by the NSSO for data collection distinguishes consumption from the PDS and from other sources. It is therefore possible to estimate the price paid at the PDS and at the open market if both sources of provision have been used by the households. Thus, it allows estimating the share of PDS in consumption expenditure and calorie intake of each household.

Impact of PDS on food security and poverty

Traditionally, the impact of PDS is assessed based on fiscal transfer method, where, expenditure gains accruing out of subsidized food transfers and consequent reduction in poverty is estimated through direct calculations. Apart from this, the recent advances in impact evaluation methodologies allow estimating the net gain by considering the counterfactuals of beneficiaries of a program. This includes propensity score matching (PSM) method that assesses the real impact of an intervention by comparing the target population with their counterfactuals through matching techniques (Rosenbaum and Robin,

1983; Heckman et al., 1997, 1998; Jalan and Ravallion, 2003; Dehejia and Wahba, 2002). The utility of this approach in understanding the net gains from India's PDS program was well demonstrated by Tritah (2003). Therefore, this paper makes use of the fiscal transfer method to assess the income (expenditure) gains, nutritional enhancement and poverty reduction arising out of PDS participation and subsequently checks the robustness of the results by using PSM by taking the case of changes in food expenditure as well as nutritional outcomes that could be attributed to PDS.

Fiscal Transfer Method

The precise impact of PDS on poverty and food security is an important but a complex question. The question is difficult to be answered as the impact of PDS is pervasive in the Indian economy and have implications for the livelihood at all levels. The fiscal transfer method assesses the direct benefit impact of PDS as a distributive mechanism on poverty and food security. The approach has been widely used in estimating benefit impact of fiscal distribution. It has been by Radhakrishna *et al* (1997), Tritah (2003), Himanshu and Sen (2013 a & b) to assess the impact of PDS.

The subsidy transfer or income gain due to PDS is defined as the additional expenditure that the household would have incurred in the absence of PDS. It is estimated by multiplying the quantity of purchases from PDS with the difference between open market price and PDS price. The income gain (ΔY) given to a household is defined as:

$$\Delta Y = Q_r(P_m - P_s)$$

Where P_m and P_s are the open market and subsidized price. Q_r is the quantity purchased from the PDS. The open market and subsidized prices are estimated from NSS survey data on quantities and values of expenditure.

Official Poverty lines provided by the Planning Commission, GoI have been used to assess the impact of PDS on poverty in this study. The extent of poverty has been measured as head count ratio (HCR) in the total population and the depth of poverty is measured by the poverty gap index (PGI) which is constructed based on the following formula (Grusky and Kanbur (2006)):

$$PGI = (\frac{1}{N}) \sum_{i=1}^{m} (z - y_i/z)$$

Where, N is the total population, m is the population who are living at or below poverty line, z is the poverty line and y_i is the income of the poor individual i. PGI by definition ranges between 0 and 100 per cent and is a measure to sense how poor the poor are?.

Similarly, the impact of PDS on calorie intake was estimated by assuming that without access to PDS, the household's budget allocation would have been the same. The quantity has been recalculated that the household would have bought in the absence of PDS. The adjusted quantity was then used to re-estimate the calorie consumption of the same household. This provides the average calorie consumption of the households without access to PDS. The

difference between the two gives the gain in calorie intake (ΔC) , which is defined as follows;

$$\Delta C = C_{pds} - C_{wpds}$$

Where C_{pds} and C_{wpds} are the actual (including from PDS) and estimated (without PDS) per capita calorie intake. In the paper, the extent of calorie deficiency has been measured by head count ratio in the total population and the depth of deficiency is measured by the Deficiency Gap Ratio (DGR)[1]. The minimum (threshold) food-energy requirement was taken as 1800 kcal/person/day for rural households and 1575 kcal for the urban households. They represented 75 per cent of the recommended values, 2400 kcal/person/day for rural and 2100 kcal/person/day for urban [for more information, see Dandekar 1996]. The households consuming below this level were treated as undernourished or deficient in calorie intake.

Propensity Score Matching Method

PSM is an innovative technique, wherein the impact of an intervention (here, participation in PDS) is assessed by comparing how outcomes differ for participants in relation to observationally similar non-participants. Based on the theoretical foundation laid by Rosenbaum and Rubin (1983), PSM uses information from a pool of units that do not participate in the intervention to identify what would have happened to participating units in the absence of intervention (Heinrich *et al*, 2010). The above method seeks to assess the

[1] Estimated with the same approach as used in the case of PGI.

impact of a treatment, 'd' for an individual 'i' by estimating the difference between the potential outcome in the case of treatment (Y_{1i}) and potential outcome in the absence of the treatment (Y_{0i}). The impact of the program denoted by 'δ_i' is expressed as:

$$\delta_i = Y_{1i} - Y_{0i} \qquad \ldots\ldots (1)$$

The mean impact of the program is obtained by averaging δ across all the treated individuals in the population. This parameter is known as average treatment effect on the treated (ATT) which is given as:

$$\hat{\delta} = E\left(Y_{1i} \middle| X_{i,}\, d_i = 1\right) - E\left(Y_{0i} \middle| X_{i,}\, d_i = 1\right) \qquad \ldots\ldots. (2)$$

Where, X_i is a set of observable characteristics of the individuals and E( ) denotes expected value.

Here, the term $E\left(Y_{0i} \middle| X_{i,}\, d_i = 1\right)$ is the average outcome that the treated individuals would have obtained in the absence of treatment (*counterfactual*), which is unobserved. However, it is possible to obtain the term, $E\left(Y_{0i} \middle| X_{i,}\, d_i = 0\right)$, which is the value of Y_0 for the untreated individuals. Therefore, we can calculate:

$$\Delta = E\left(Y_{1i} \middle| X_{i,}\, d_i = 1\right) - E\left(Y_{0i} \middle| X_{i,}\, d_i = 0\right) \quad \ldots\ldots. (3)$$

Upon re-arranging the equation (3), it could be established that, $\Delta = ATT + SB$, where SB is the selection bias, which is defined as the difference between the unobserved *counterfactual* for the treated individuals and the observed

outcome for the treated individuals. If SB = 0, then ATT can be estimated by taking the mean observed outcomes for the treated and the untreated. In the past literature on this topic, there is a consensus that, by randomly assigning units into treatment and control groups, one can minimize the selection bias. However, participation in most socio-economic programs being non-random and conditional based on X, an alternative approach called 'matching' can be followed that helps in obtaining unbiased estimator of ATT. Matching essentially helps in pairing a participant unit with an observationally similar non-participant so that, the difference in their outcomes is as good as the difference between the treatment outcome and its *counterfactual*. With no underlying selection bias, this difference can be interpreted as the effect of the program (Smith and Todd, 2005).

Among the various matching techniques, PSM is a methodologically superior technique, wherein, treated and untreated units are matched based on the estimated probability P(X), called propensity score. It is the probability that a unit in the combined sample of the treated and untreated receives the treatment, given a set of observable characteristics. Rosenbaum and Rubin (1983) who proposed the underlying theory has established that, under certain qualifying assumptions, matching on propensity score is as good as matching on X. PSM rests on two basic assumptions:

Conditional independence or *unconfoundedness* assumption: This assumption holds that, after conditioning on the observables (X), treatment group would

have the same outcome Y_0, as the control group members in the absence of the treatment.

Common support or *overlap* assumption: For each possible value of the vector of covariates X, there must be appositive probability of finding both a treated and untreated unit, so that valid matches could be found for all d=1.

Propensity score is generally estimated by fitting a probit or logit model with participation in the program as the dichotomous dependent variable (d=1 if participant; d=0 if not). All observed characteristics that the researcher finds as determining factors for participation in the program, thereby impacting the outcome variable Y, are included as explanatory variables. Necessary balancing tests have to be conducted to ascertain that the average propensity score and mean of X variables are the same within propensity score distribution quintiles. Several alternative algorithms are used to match the treated units with that of control. Commonly employed matching algorithms include *nearest neighbor matching, radius matching, stratification matching, kernel matching,* etc. (See Heinrich *et al.* (2010) for details). After matching, ATT and associated standard errors are estimated and compared to assess the impact of the program.

In this paper, PSM was applied to assess the income gains as well as nutritional impact of participation of the below poverty line (BPL) households in PDS. The food consumption expenditure and calorie consumption levels of participants and non-participants were compared to assess whether PDS is

enhancing their economic and nutrition status. The study used the 68th round data of the NSSO pertaining to the year 2011-12, for this purpose. The sample was categorized into BPL and non-BPL households based on the officially accepted income criteria for various states. The analysis was limited to the BPL households, though those above poverty line also participated in the PDS. A probit model was fitted with PDS participation as the dependent variable and several demographic and socio-economic determinants as explanatory variables. The functional form of the fitted model is given in Equation 1 as below:

PDS_BEN = f (*CONST, AGE_HEAD, EDU_HEAD, EDU_SQ, MPCE, MPCE_SQ, CHILDREN, F_HEAD, SC_ST, RURAL, NO_CARD*)

…… (1)

Where,

PDS_BEN = Dichotomous variable for participation in PDS (1 if beneficiary and 0 if non- beneficiary)

CONST = Constant term

AGE_HEAD = Age of head of the household in years

EDU_HEAD = Maximum education of the head of the household in number of years

EDU_SQ = Square term of EDU_HEAD

MPCE = Monthly per capita income of the household in Rupees

MPCE_SQ = Square term of MPCE_SQ

CHILDREN = Number of the children under the age of 14 in the household

F_HEAD = Dummy variable for female-headed household

SC_ST = Dummy variable for households of scheduled caste or scheduled tribe

RURAL = Dummy variable for households belonging to rural areas

NO_CARD = Dummy variable for households not possessing PDS ration card.

The estimation of the probit model and subsequent computations on propensity scores were carried out using the 'pscore.ado'[2] module in the STATA software. Subsequently, the ATT estimates based on *nearest neighbor matching* was obtained and presented.

Results and Discussion

Access to PDS

Table 1 provides a snapshot of the reach of people to PDS foodgrains during 1993-94, 2004-05, 2009-10 and 2011-12. The PDS reach shrunk between 1993-94 and 2004-05, during which, the percentage of households accessing PDS cereals fell from 27.7 per cent to 23.3 per cent. The shrinkage was sharp in urban areas from 29.8 per cent to 14.7 per cent, whereas, the decline in rural area was negligible. This shrinkage may be attributed to the

[2] This module was developed by Becker and Ichino (2002) and is available for download at http://sobecker.userweb.mwn.de/pscore.html.

shift from universal to TPDS in 1997 along with sharp increase in issue prices for APL households. This eliminated the existing urban bias to a great extent, but appeared to have increased exclusion errors significantly (Himanshu and Sen, 2013). But, the share of PDS in consumption of cereals increased slightly from 8.5 per cent to 9.8 per cent during this period and the increase was confined to rural households only (from 7.7% to 10.6%). In urban households, it declined from 11.4 per cent to 7.3 per cent.

Table 1: Contribution of PDS in household consumption of foodgrains

Year	Households accessing PDS for cereals (%)			Share of PDS in cereal consumption (%)		
	Rural	Urban	All	Rural	Urban	All
1993-94	26.6	29.1	27.3	7.7	11.4	8.5
2004-05	26.6	14.7	23.3	10.6	7.3	9.8
2009-10	44.9	26.2	39.4	19.3	13.2	17.8
2011-12	52.1	28.5	44.8	21.7	13.9	19.7

Source: Authors' estimates based on unit level data from NSSO surveys

The subsequent period after 2004-05 saw a reversal of the earlier shrinkage in terms of access to PDS. The percentage of people who accessed PDS cereals in 2011-12 was much higher than that in 2004-05 and 1993-94. In 2011-12, 44.7 per cent of the households accessed PDS for purchase of cereals, with 52.1 per cent in rural areas and 28.5 per cent in urban areas. In terms of quantity also, this increase was explicitly evident. PDS accounted for about one-fifth (19.7%) of the total consumption of rice and wheat in 2011-12, with 21.7 per cent in rural areas and 13.9 per cent in urban areas. The expansion PDS access was widespread and improvement was recorded in most of the Indian states. By 2009-10, a majority of households were accessing

PDS cereals in 13 out of 30 states, up from only 6 in 2004-05 (Table 2). The revival of PDS continued and access expanded significantly in 2011-12 during which the number of states where the majority accessed the PDS for cereals went up to 20. Some states were particularly noteworthy for showcasing exemplary improvement in PDS performance during the last few years. The most notable case is Bihar, so far considered the worst performer in the functioning of PDS. More than 42 percent of households in Bihar accessed PDS cereals in 2011-12, up from only 14 per cent in 2009-10 and less than 2 per cent in 2004-05. The share of PDS in consumption of cereals in Bihar was next to nil (0.2%) in 1993-94, and less than 1 per cent in 2004-05, which went up to 17.8 per cent in 2011-12. Similarly, Chhattisgarh, Uttarakhand, Tripura, Odisha, etc. also recorded significant improvement in the expansion of PDS access during this period.

Table 2: Contribution of PDS in household consumption of foodgrains across states in India

State	% households accessing PDS for cereals				Share of PDS in cereal consumption (%)			
	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
Andhra Pradesh	57.5	54.6	72.2	73.9	20.3	20.4	28.5	27.1
Arunachal Pradesh	77.3	40.2	46.7	52.3	50.2	25.8	28.3	31.0
Assam	20.9	8.4	27.2	50.4	4.1	3.5	10.0	22.1
Bihar	0.7	1.9	12.1	42.2	0.3	0.8	4.7	17.8
Chhattisgarh	11.8	22.7	62.2	58.8	3.2	11.3	37.8	34.3
Goa	74.9	11.0	47.8	60.8	42.7	7.5	17.8	25.3
Gujarat	35.5	24.0	26.1	21.6	15.0	9.3	11.4	7.6
Haryana	4.6	4.4	16.4	15.7	1.0	2.7	11.4	11.2
Himachal Pradesh	43.7	47.0	79.4	82.1	26.4	30.2	43.9	43.3
Jammu &	20.3	37.4	63.5	76.2	12.1	28.6	46.9	47.1

Kashmir								
Jharkhand	12.7	5.5	23.7	27.6	2.6	2.0	13.5	15.0
Karnataka	54.6	47.1	56.4	60.3	17.1	34.5	32.9	26.0
Kerala	78.3	36.7	57.1	76.8	44.8	18.7	26.3	34.0
Madhya Pradesh	11.2	20.9	42.3	35.6	3.3	11.2	19.2	16.6
Maharashtra	32.5	21.1	33.1	31.3	12.4	15.4	21.8	17.6
Manipur	3.7	0.5	8.5	5.3	2.1	0.3	2.4	1.4
Meghalaya	60.8	19.0	54.0	60.6	20.8	10.3	26.1	27.0
Mizoram	91.9	63.5	90.8	92.6	54.5	37.2	41.5	46.9
Nagaland	4.2	0.2	0.0	13.8	3.1	0.0	0.0	5.4
Odisha	6.4	19.4	49.9	58.3	1.2	6.0	22.3	27.2
Punjab	1.5	0.4	18.8	17.4	0.8	0.3	11.5	10.1
Rajasthan	14.2	10.1	16.4	26.0	10.6	8.1	9.0	10.4
Sikkim	47.1	38.4	38.5	45.9	47.9	28.7	31.3	36.5
Tamil Nadu	65.7	68.2	84.2	82.6	19.3	35.1	47.9	47.8
Tripura	57.0	33.7	72.0	81.3	19.8	20.7	31.9	40.1
Uttar Pradesh	1.6	5.7	21.5	24.7	0.6	2.4	10.0	12.4
Uttarakhand	56.3	20.3	28.3	63.4	44.1	13.1	16.0	25.9
West Bengal	16.4	12.7	32.2	43.4	3.9	2.9	8.3	12.3
All India	27.3	23.3	39.4	44.7	8.5	9.8	17.8	19.7

Source: Same as in Table 1

The impressive advances discussed above could be partly attributed to the sharp increase in food inflation, which made PDS more attractive. Also, in recent years, many states have taken several initiatives to revive PDS infrastructure and to plug the rampant leakages in PDS grains distribution. A number of studies report improvements in the functioning of PDS and reduction in leakages (for example, Khera, 2011a and 2011b; Himanshu and Sen, 2011; Kumar *et al.*, 2012). The estimated proportions of cereals diverted from PDS in 1993-94, 2004-05, 2009-10 and 2011-12 are depicted in Table 3[3].

[3] Using NSS data on per capita monthly purchase of wheat and rice from the PDS, the aggregate purchase of PDS cereals in each state has been estimated. This total purchase by the consumers has been compared with the corresponding 'offtake' figure for that state. The

At the all-India level, the leakages from the PDS have been consistently declining since 2004-05. It declined from 53 percent in 2004-05 to 39 percent in 2009-10 and further to 35 percent in 2011-12. Though there has been decline in the extent of leakages from PDS in most of the states, leakages continue to be alarmingly high in Gujarat (62.2%), Haryana (45.9%), Manipur (95.4%), Rajasthan (65.7%), Uttar Pradesh (57.9%), Uttarakhand (53.6%) and West Bengal (68.7%). Diversion of PDS grain was observed to be nil in Chhattisgarh, Jammu & Kashmir and Tamil Nadu. The extent of leakages in Andhra Pradesh (9.9%), Himachal Pradesh (19.0%), Karnataka (20.8%) and Kerala (24.4%) was relatively less. Bihar's PDS grain leakages reduced to about 20 per cent in 2011-12 from 65 per cent in 2009-10 and 97 per cent in 2004-05. Assam, Tripura, Uttarakhand and West Bengal also recorded considerable reduction in leakages of PDS grains.

Table 3: Trends in diversion of PDS foodgrains (%)

State	1993-94	2004-05	2009-10	2011-12
Andhra Pradesh[#]	8.7	24.6	9.9	-3.5
Arunachal Pradesh	25.4	46.6	39.8	21.2
Assam	73.1	88.1	66.5	37.9
Bihar	94.6	91.3	70.0	2.5
Chhattisgarh[#]	NA	49.6	-33.0	-17.9
Goa	30.7	-10.9	32.6	34.8
Gujarat	49.0	50.3	48.5	62.2

difference between 'offtake' and purchase provides an estimate of the 'diversion' of PDS foodgrains to the open market.

[#] These states (possibly a few other also) augment centrally allocated grain through open market sales or open market purchase or "state pool" contributions. Using the allocation and offtake figures reported in the monthly food grains bulletins leads to underestimation of grain bulletin diversion. For accurate estimation, the grain allocated to the PDS by the state from local procurement and other sources should be added to the offtake figure. The lack of readily availability of data on contribution of state pool constrained further analysis in this article.

Haryana	91.2	83.5	35.5	45.9
Himachal Pradesh	56.0	24.4	19.0	17.3
Jammu & Kashmir[#]	83.9	17.3	-12.0	-21.2
Jharkhand	NA	84.2	41.7	30.9
Karnataka	40.3	27.4	20.8	17.6
Kerala	20.9	24.9	24.4	18.6
Madhya Pradesh	50.0	46.4	43.7	37.8
Maharashtra	56.6	47.6	39.1	37.1
Manipur	88.3	98.0	91.2	95.4
Meghalaya	61.7	64.9	35.6	45.5
Mizoram[#]	43.4	45.0	11.6	-18.0
Nagaland	94.4	100.0	100.0	87.8
Odisha	85.8	73.4	27.4	11.4
Punjab	84.6	94.2	65.0	55.7
Rajasthan	97.9	55.3	65.7	52.6
Sikkim	47.7	42.3	46.4	38.2
Tamil Nadu[#]	-12.6	-4.6	0.5	-3.4
Tripura	49.9	44.9	32.3	11.2
Uttar Pradesh	59.8	83.7	57.9	50.0
Uttaranchal	NA	19.5	53.6	16.8
West Bengal	80.8	84.5	68.7	53.1
India	46.7	52.9	39.3	28.5

Note: NA denotes 'not available' Source: Same as in Table 1

The trends in increasing contribution of PDS in foodgrains consumption and reducing PDS leakages clearly indicate that wider PDS access reduces PDS leakages. This has been observed earlier by Himanshu and Sen (2011) and Kumar *et al.* (2012). The correlation across states between access and leakage was found negative and significant.

Trends in Income Transfers through PDS

Table 4 presents the value of in-kind food transfers through PDS. The value of per capita PDS food transfers is calculated as the excess, if any, of the market cost of PDS purchases over what was actually incurred as out of pocket expenditure on them. To maintain the temporal comparability, the PDS

transfers were converted into real terms at 2004-05 prices. On an average, an amount of Rs. 286 per person at 2004-05 prices, was transferred to a household through PDS in 2011-12, up from Rs.86 in 1993-94. This transfer accounted for only 1.4 per cent of the per capita consumption expenditure of a household in 1993-94, which increased to 2.2 per cent in 2011-12. Such transfer was higher in rural areas (Rs. 313) than in urban areas (Rs. 217). However, the transfer was pro-urban in 1993-94, wherein income transfer to the rural household was only Rs. 86 per person in comparison to Rs. 146 per person in urban areas. The changing trends in PDS transfers explicitly reflect the waning urban-bias, and its renewed pro-rural inclination, where the concentration of poor is higher.

Table 4: Trends in income transfer through PDS at 2004-05 prices

Year	Rural		Urban		All	
	PDS Subsidy (Rs./person)	Share of subsidy in expenditure (%)	PDS Subsidy (Rs./person)	Share of subsidy in expenditure (%)	PDS Subsidy (Rs./person)	Share of subsidy in expenditure (%)
1993-94	86	1.3	146	1.4	101	1.4
2004-05	116	1.6	103	0.8	113	1.3
2009-10	329	3.3	262	1.4	310	2.5
2011-12	313	3.1	217	1.1	286	2.2

Source: Same as in Table 1

The share of PDS transfers in monthly per capita expenditure (MPCE) increased over time in most of the states. The states like Assam, Bihar, Chhattisgarh, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Madhya Pradesh, Odisha and Sikkim registered remarkable increase in contribution of PDS subsidy to the monthly per capita expenditure (Table 5). In some states,

the share of PDS subsidy in MPCE increased 3-4 times and even more between 1993-94 and 2011-12. In Odisha, the share increased from 0.80 per cent in 1993-94 to 5.6 per cent by 2011-12. Similarly, Bihar and Chhattisgarh also offer convincing evidence for improvement in PDS subsidy over time. On the other hand, the contribution of PDS subsidy in some other states showed either stagnation or slight decline. They include Goa, Gujarat, Haryana, Manipur, Nagaland, Punjab and Rajasthan. There has been considerable variation across states in the extent of income transfer through PDS, though its intensity declined over time. Evidently, the coefficient of variation in income transfer across different states declined from 92 per cent in 1993-94 to 73 per cent in 2011-12.

Table 5: Trends in income transfers through PDS across different states in India

State	PDS Subsidy (Rs./person) at 2004-05 prices				Share of PDS subsidy in expenditure (%)			
	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
Andhra Pradesh	202	194	627	523	2.7	2.2	4.3	3.5
Arunachal Pradesh	217	54	342	315	2.8	0.6	2.2	2.5
Assam	69	69	214	310	1.1	0.9	2.1	3.3
Bihar	43	47	127	232	0.8	0.8	1.6	2.9
Chhattisgarh	55	82	632	441	0.9	1.3	7.1	5.1
Goa	244	78	220	344	2.1	0.6	1	1.6
Gujarat	115	149	189	130	1.4	1.5	1.4	0.9
Haryana	66	23	104	79	0.7	0.2	0.6	0.4
Himachal Pradesh	105	163	613	583	1.2	1.5	4	3.8
Jammu & Kashmir	107	184	618	614	1.2	1.7	4.5	4.4
Jharkhand	50	35	215	279	0.9	0.5	2.3	3.1
Karnataka	106	263	467	415	1.5	3	3.5	2.8
Kerala	270	159	391	497	2.8	1.2	2.1	2.5
Madhya Pradesh	45	54	226	185	0.7	0.8	2.2	1.9
Maharashtra	76	87	221	196	0.9	0.8	1.4	1.2

Manipur	21	15	81	43	0.3	0.2	0.8	0.4
Meghalaya	138	67	294	281	1.6	0.7	2.6	2.3
Mizoram	387	217	544	736	3.8	1.8	3.7	5
Nagaland	51	0	0	58	0.5	0	0	0.4
Odisha	43	60	399	468	0.8	1	4.6	5.6
Punjab	50	8	108	80	0.5	0.1	0.6	0.4
Rajasthan	53	48	104	115	0.7	0.6	0.8	0.9
Sikkim	71	245	467	578	1	2.6	3.5	4.4
Tamil Nadu	262	474	1095	740	3.3	4.8	7.6	4.7
Tripura	213	203	562	599	2.6	2.9	4.6	5.7
Uttar Pradesh	37	49	164	145	0.5	0.7	1.7	1.4
Uttaranchal	271	98	222	450	3.4	1.1	1.3	3.2
West Bengal	99	93	197	238	1.3	1.1	1.7	2
India	101	113	310	286	1.4	1.3	2.5	2.2

Source: Same as in Table 1

Impact of PDS on Poverty

The increased access to PDS has also played a role in reducing the poverty and enhancing the food security in the country. The PDS contributed to overall reduction in poverty by 3.5 per cent points in 2011-12, with 4.2 per cent points in rural areas and 1.7 per cent points in urban areas (Table 6). Though in percentage terms the change look small, in absolute terms, it amounts to around 40 million people who came out of poverty. It was also worth noting that, the impact of PDS transfers to poverty reduction has increased over time. The contribution of PDS transfers to poverty reduction was only 1.5 per cent points in 1993-94, which rose to 3.5 per cent points in 2011-12. Further, the contribution of PDS transfers in poverty reduction was more in rural areas than in urban areas, except in 1993-94. The impact of PDS transfers is also visible in reducing the poverty gap index. The poverty gap index was found declining over time with similar trends as that in the case of

head count ratio. This implies that PDS resulted not only in reducing the number of poor people but also the extent to which they are poor. Appendix Table 1 provides the impact of PDS on poverty at disaggregate level throwing further insights on the distribution aspects of the program across space.

Table 6: Impact of PDS on poverty

Sector	Poverty rate "with TPDS"	Poverty rate "without TPDS"	Average impact on HCR ("without"-"with")	Average normalized poverty gap with PDS	Average normalized poverty gap without PDS	Average impact on PGI
			Rural			
1993-94	55.3	56.7	1.4	13.47	14.28	0.81
2004-05	41.8	43.9	2.1	7.96	9.08	1.12
2009-10	33.3	38.0	4.7	5.53	7.89	2.35
2011-12	25.3	29.5	4.2	3.71	5.43	1.71
			Urban			
1993-94	36.1	37.9	1.8	7.44	8.15	0.71
2004-05	25.7	26.8	1.2	4.41	5.00	0.60
2009-10	20.8	23.4	2.5	3.26	4.41	1.15
2011-12	13.7	15.4	1.7	1.74	2.32	0.58
			All			
1993-94	50.5	52.0	1.5	9.72	10.41	0.69
2004-05	37.7	39.6	1.9	6.99	7.96	0.97
2009-10	29.9	34.0	4.1	4.86	6.86	2.00
2011-12	22.0	25.5	3.5	2.68	3.79	1.12

Source: Same as in Table 1

The contribution of PDS transfers in reducing the incidence and depth of poverty is even more evident from Table 7 that depicts the impact of PDS on poverty across various types of beneficiary groups. The results show that the

PDS has been instrumental in reducing poverty among the targeted groups like Antyodaya and BPL card holders more effectively. The findings suggest a poverty reduction of 6.7 per cent points in case of Antyodaya and 4.1 per cent points in case of BPL card holders in 2004-05. The estimates went up to 10.1per cent points and 8.0 per cent points respectively in 2011-12 suggesting achievement of enhanced targeting efficiency during the recent period. The average impact on poverty gap during 2004-05 was estimated to be 5.96 per cent points for Antyodaya beneficiaries and 2.27 percentage points for BPL. The impact remained more or less in the same range in 2011-12 too with respective estimates of 5.90 per cent points and 3.02 per cent points respectively for the two target groups.

Table 7: Impact of PDS on poverty across beneficiary groups

Year	Sector	Poverty rate "with TPDS"	Poverty rate "without TPDS"	Average impact on HCR ("without "-"with")	Average normalized poverty gap with PDS	Average normalized poverty gap without PDS	Average impact on PGI
2004-05	Antyodaya	66.0	72.7	6.7	15.75	21.71	5.96
	BPL	54.8	58.9	4.1	11.01	13.28	2.27
	Other	30.1	31.4	1.3	4.92	5.49	0.57
	All card holder	37.9	40.1	2.2	6.99	8.21	1.22
2011-12	Antyodaya	48.7	58.9	10.1	8.96	14.86	5.90
	BPL	32.3	40.2	8.0	4.99	8.01	3.02
	Other	13.5	14.6	1.1	1.56	1.88	0.32
	All card holder	22.3	26.5	4.2	3.29	4.94	1.66

Source: Same as in Table 1

Impact of PDS on Food Security

The improvement in physical access of food to the PDS beneficiaries has brought about commensurate changes in their nutritional status over time. The findings of the study indicate that, the share of PDS in calorie consumption has been increasing continuously since 2004-05. The share of PDS in per capita calorie intake was 7 per cent in 1993-94, which slightly declined 5.8 per cent in 2004-05. Thereafter, it showed an increasing trend and in 2011-12, PDS accounted for about 12 per cent of calorie intake in India. This trend has been pervasive across states with notable outcomes in Bihar, Chhattisgarh, Jammu and Kashmir, Odisha, etc. (Appendix Table 2). The impact of PDS in improving the nutritional security of its beneficiaries was further examined based on fiscal transfer method. The findings suggest to laudable performance of PDS in reducing the food insecurity of people in the country. At the country level, the incidence of nutrition deficiency in terms of calorie intake would have been 36 per cent in the absence of PDS in 2011-12, but PDS has been able to tame it to 20.8 per cent (Table 8). This translates to almost 50 per cent reduction in nutrition deficiency on account of interventions through PDS. As results indicate, the contribution of PDS in ensuring food security has been increasing over time. In 1993-94, 3.4 per cent points of the Indian population could escape the incidence of energy deficiency due to PDS. The impact kept on increasing with 4.5 per cent points of decline in nutrition deficiency in 2004-05 and 11.1 per cent points decline

in 2009-10, and further by 15.4 per cent points in 2011-12, the latest in the series. On similar lines, the depth of nutrition deficiency as measured by NGI also kept on decreasing over years, with the average impact increasing for successive rounds of data. With increased access in rural areas, the impact of PDS on food security has been more than their counterparts in urban areas during all years under study except 1993-94.

Table 8: Impact of PDS on food security

Sector	Nutrition deficiency "with TPDS"	Nutrition deficiency "without TPDS"	Average impact on nutrition deficiency ("without"- "with"	Average normalized nutrition gap with PDS	Average normalized nutrition gap without PDS	Average impact on NGI
			Rural			
1993-94	31.2	34.2	3.1	4.97	5.96	0.99
2004-05	31.2	35.9	4.7	4.46	6.84	2.39
2009-10	27.4	39.4	12.0	3.17	7.86	4.69
2011-12	24.2	42.0	17.8	2.66	8.37	5.70
			Urban			
1993-94	19.1	23.3	4.2	2.96	3.77	0.81
2004-05	11.1	14.9	3.8	1.63	2.35	0.72
2009-10	16.1	24.6	8.5	1.72	3.83	2.11
2011-12	12.3	21.8	9.5	1.06	3.03	1.98
			All			
1993-94	28.2	31.5	3.4	3.66	4.53	0.86
2004-05	26.1	30.6	4.5	3.68	5.61	1.93
2009-10	24.3	35.4	11.1	2.74	6.67	3.93
2011-12	20.8	36.2	15.4	1.93	5.91	3.98

Source: Same as in Table 1

The role of PDS in taming nutrition deficiency seems to be more critical among the Antyodaya and BPL cardholders. A little less than half of Antyodaya cardholders (45.2%) and one-third of BPL card holders could get adequate calorie only because of the PDS in 2011-12 (Table 9). Though relatively lower in terms of impact, the contribution of PDS in improving nutritional intake of Antyodaya and BPL in 2004-05 was also appreciable. A similar analysis across states proves that the nutrition enhancing impact of PDS has been widespread through the country though the effects were disproportionate across states (Appendix Table 3). These evidences clearly suggest that food transfers through PDS have considerable impact on improving food security and thus should be further strengthened.

Table 9: Impact of PDS on food security across beneficiary groups

Year	Sector	Nutrition deficiency "with TPDS"	Nutrition deficiency "without TPDS"	Average impact on nutrition deficiency ("without"-"with")	Average normalized nutrition gap with PDS	Average normalized nutrition gap without PDS	Average impact on NGI
2004-05	Antyodaya	38.6	65.0	26.4	5.03	17.85	12.81
	BPL	37.0	49.4	12.4	5.20	10.05	4.85
	Other	20.9	22.8	1.9	2.42	3.38	0.96
	All card holder	25.8	31.3	5.5	3.29	5.72	2.43
2011-12	Antyodaya	27.4	72.6	45.2	2.82	20.48	17.66
	BPL	24.5	58.8	34.3	2.61	12.48	9.87
	Other	17.0	22.2	5.2	1.70	3.13	1.43
	All card holder	20.4	38.5	18.1	2.11	7.66	5.55

Source: Same as in Table 1

Robustness Checks using PSM

As outlined in methodology, the robustness of impact of PDS in enhancing income and nutritional status of beneficiaries was checked by applying PSM technique. This was done using the NSSO data on consumer expenditure pertaining to the year 2011-12. The sample contained both PDS beneficiaries as well as non-PDS beneficiaries who belonged to the BPL category. The descriptive statistics of the demographic as well as socio-economic characteristics of the treatment (PDS-beneficiary) and control (PDS non-beneficiary) groups belonging to the sample are presented in Appendix Table 4. The total sample consisted of 26036 observations of which, 15976 were PDS beneficiaries and the rest 10060 were non-beneficiaries. A probit regression was fitted on this data to estimate the propensity scores and on the basis of which matching was done subsequently (Table 10). The dichotomous variable, 'PDS_BEN' that assumes a value of '1' if the household is a PDS beneficiary and '0' if not, was taken as the dependent variable.

Table 10: Probit regression of participation in PDS in India

Dependent variable: PDS_BEN (1 if beneficiary and 0 if non-beneficiary)

Explanatory variables	Coefficient	Standard error	z-value
CONSTANT	2.046***	0.156	13.07
AGE_HEAD	-0.002***	0.001	-2.63
EDU_HEAD	0.016***	0.005	2.83
EDU_SQ	-0.004***	0.000	-8.24
MPCE	-0.002***	0.000	-5.18
MPCE_SQ	0.000**	0.000	2.38
CHILDREN	-0.113***	0.005	-19.56
F_HEAD (Dummy)	0.131***	0.028	4.64

SC_ST (Dummy)	0.188***	0.018	10.05
RURAL (Dummy)	0.044**	0.020	2.18
NO_CARD (Dummy)	-2.062***	0.029	-69.71
Number of observations	26036		
LR Chi^2 (10)	8734.3		
Prob > Chi^2	0.00		
Pseudo R^2	0.25		

Note: *** and ** denote significance at 1 per cent and 5 per cent levels respectively.

The estimated probit regression was significant at 1 per cent level as indicated by the probability of the LR Chi^2 statistic. The signs and magnitude of the coefficients corresponding to the explanatory variables were in line with intuitive expectations. The variable AGE_HEAD had a negative sign indicating that households with younger heads had a greater chance for participation in the PDS. Similarly, education level of the head also played a positive role in enhancing the participation in PDS as indicated by its positive and significant coefficient. The households with lower monthly per capita expenditure were more inclined to access PDS services. Interestingly, the coefficient of the variable CHILDREN was negative (-0.113) thereby suggesting that households with more number of children was less likely to participate in PDS. It could be justified from the point of view that, more number of children in a family indicates its acute backwardness under Indian circumstances and thereby less aware of the government welfare programmes. Female headed households had a greater chance to be enrolled in PDS as was the case of households belonging to SC and ST categories. Similarly, rural households had significantly higher probability to become PDS beneficiaries

in relation to their urban counterparts. As possession of a ration card is the basic criterion that determines access to the PDS services, the variable NO_CARD had a very high negative and significant coefficient (-2.06). This clearly suggests that, non-possession of ration card is a defining factor that renders a household inaccessible to the PDS. The above results vividly bring out the fact that targeting has been successful to a great extent in India. Evidently, female-headed households, backward caste households, lower income households, etc. find greater chances to be able to participate in the subsidized PDS services. However, those households with younger and better educated heads were more likely to get themselves enrolled to the government sponsored welfare program.

Based on the observable variables that were included in the probit regression, the propensity scores for the treatment as well as control groups of households were estimated. The histograms of the propensity scores corresponding to the PDS and non-PDS households are presented in Appendix Figures 1 and 2 respectively. Within the region of common support, the mean value of the estimated propensity score was 0.61 with a standard deviation of 0.26. The final number of blocks was 14, into which the estimated propensity scores were categorized. This ensures that, the mean propensity score in each block for the treatment and control groups is not different so that matching could be done with minimum bias. The balancing property was satisfied thereby warranting that treatment is independent of unit characteristics after

conditioning on the observed variables. The ATT estimates that corresponds to the changes in household food expenditure, food share in total expenditure as well as net gains in calorie consumption from participation in PDS based on matching algorithms are presented in Table 11.

Table 11: ATT estimates (nearest neighbor) corresponding to food expenditure, food share in total expenditure and calorie consumption of sample households

Mean effects on the parameter	ATT	Standard error	t-value
Monthly food expenditure (Rs.)	-152.4***	26.4	-5.78
Average share of food in total expenditure (%)	-1.79***	0.19	-9.42
Calorie consumption (K Cal/day)	79.39***	7.42	10.70

*** denote significance at 1 per cent level. Source: Same as in Table 1

The ATT estimates pertaining to all three parameters were found to be significant at 1 per cent level. Based on nearest neighbor matching, the monthly household food expenditure of the treatment group was found to be lower than the control group by Rs. 152.4 with a standard error of 26.4. This suggests that PDS participation lowers the food expenditure of the beneficiaries on account of the subsidy component associated with the food transfers. Further, the share of food in total expenditure of the PDS beneficiaries was observed to be lower than the counterfactuals by 1.79 per cent, thereby allowing the households to spend a greater share of their income on other non-food necessities. These findings reinforce the earlier findings of the study that, PDS enhances the economic status of the households thereby enabling them to escape from the poverty trap. On the nutrition front, the calorie gain that could be attributed to PDS participation was estimated to be

79.39 KCal/day with a standard error of 7.42. This clearly underscores the benefits of PDS in enhancing nutritional intake of BPL households in India. In nutshell, the results of the PSM analysis conclusively proves the income augmentation and nutrition enhancement effects of India's PDS thereby attributing a part of the success of poverty alleviation as well as malnutrition eradication efforts undertaken in the country to this well acclaimed program that has been a part of India's development story over decades.

Conclusions and Policy Implications

PDS in India is one of the largest welfare programmes in the world with the primary aim of improving food and nutrition security of the socially and economically deprived sections in the country. Though it managed to survive through the innumerous challenges over decades, PDS is facing intense scrutiny in the midst of neo-liberal ideas of replacing it with alternatives such as food stamps, cash transfers, etc. In this context, this paper attempts to assess the impact of PDS in improving the economic access of the poor to essential food grains and consequent nutritional outcomes over the past decade and half. The study used fiscal transfer method to estimate the subsidy transfer through PDS and its indirect benefits as a window for the poor to escape poverty. Through this the average impact of PDS on head count ratio of poverty as well as poverty gap index were worked out. The findings suggest that at All India level, poverty rate reduced by around 3.5 per cent points in 2011-12 on

account of PDS subsidy transfers. Such impact was pervasive across rural/urban and regional divide across the country. The effectiveness of PDS as a tool to alleviate poverty was found to deepen over the years with observed maximum impact in 2011-12. The effectiveness of the program was also reflected in terms of decreasing the depth of poverty as measured by poverty gap index. In addition to taming poverty, PDS also contributed substantially in improving nutrition intake of the beneficiaries. The study observed that, the decrease in nutrition deficiency at all India level was as high as 15.4 per cent points in 2011-12. The impact of PDS in tackling under-nutrition was found to deepen across successive rounds of the survey. The robustness of the results was checked based on PSM technique wherein, the PDS beneficiaries that belonged to BPL category were compared against the BPL non-beneficiaries as counterfactuals. The results of PSM analysis confirmed the impact of PDS in augmenting the incomes as well as improving nutrition security of the beneficiaries. With the above findings, the study draws strong conclusions in favour of PDS as an effective tool in targeting the twin problems of poverty and under-nourishment in the country. The study also established that, the effectiveness of PDS has improved over time. However, persisting imperfections in the system still pose substantial challenges to be tackled from time to time. This necessitates proactive and systematic attempts to continually improve the functioning, so that one among the largest welfare programmes in the world maintain its glory in times to come.

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Appendix Table 1: Impact of PDS on poverty across states in India based on fiscal benefit method

State	Average impact on HCR ("without"-"with")				Average impact on PGI			
	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
Andhra Pradesh	3.2	3.3	6.86	3.92	1.93	1.39	1.73	0.96
Arunachal Pradesh	1.85	0.71	1.68	2.03	1.04	0.26	0.84	1.23
Assam	1.63	1.1	2.39	6.12	0.69	0.51	1.24	1.87
Bihar	0.94	0.58	1.96	4.89	0.4	0.49	0.82	1.72
Chhattisgarh	0.78	1.5	8.81	8.98	0.5	1.09	6.08	4.51
Delhi	3.37	0.5	0.00	0.71	0.76	0.14	0.10	0.08
Goa	2.97	0.41	0.76	1.8	0.92	0.6	0.35	0.31
Gujarat	2.16	2.68	3.16	1.27	0.77	0.96	0.69	0.51
Haryana	0.89	0.52	1.22	0.6	0.38	0.15	0.38	0.3
Himachal Pradesh	1.38	2.07	2.50	6.16	0.57	0.85	0.63	0.82
Jammu & Kashmir	2.5	3.15	3.17	4.73	0.52	0.5	0.85	1.04
Jharkhand	1.23	0.82	3.93	3.8	0.51	0.47	1.80	2.8
Karnataka	1.44	4.88	7.62	4.81	0.81	2.22	1.75	1.36
Kerala	3.41	1.85	2.83	3.31	1.49	0.77	0.78	0.88
Madhya Pradesh	0.85	0.88	3.43	2.42	0.31	0.81	1.97	1.71
Maharashtra	0.76	1.11	2.75	2.32	0.44	0.74	0.86	0.9
Manipur	0.3	0.38	1.43	0.85	0.19	0.07	0.35	0.18

Meghalaya	2.27	2.09	4.36	3.18	0.68	0.23	0.41	0.73
Mizoram	5.45	2.77	4.09	9.07	0.92	0.62	1.20	2.53
Nagaland	0.57	0	0.00	0.63	0.16	0	0.00	0.1
Odisha	0.72	0.85	6.49	7.72	0.4	1.03	3.34	4.67
Punjab	0.53	0.05	0.87	0.6	0.18	0.02	0.29	0.14
Rajasthan	0.62	0.89	1.25	1.13	0.39	0.38	0.38	0.51
Sikkim	1.26	5.87	6.56	7.5	0.46	1.78	1.31	1.12
Tamil Nadu	3.37	8.38	9.06	6.93	2.12	3.54	3.20	1.88
Tripura	3.51	3.7	5.73	9.39	1.18	2.56	0.98	2.34
Uttar Pradesh	0.63	0.89	2.64	2.18	0.26	0.46	1.13	1.02
Uttaranchal	4.06	1.49	3.47	5.67	1.85	0.71	0.61	1.02
West Bengal	1.68	1.32	3.13	3.72	0.58	0.55	0.83	1.22
India	1.5	1.87	3.80	3.52	0.69	0.97	1.42	1.12

Appendix Table 2: Per capita calorie consumption and share of PDS across states in India

State	Per capita calorie consumption (KCal/person/day)				Share of PDS in total calorie consumption (%)			
	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
Andhra Pradesh	2068	2083	2520	2256	15.4	13	13.9	16.3
Arunachal Pradesh	2238	2399	2787	2020	36.4	17.7	14.7	23.5
Assam	2012	2241	2208	2088	5.1	3.2	6.8	16.9
Bihar	2168	2186	2085	2141	1.8	0.5	3.1	11.4
Chhattisgarh	2132	2019	2204	2123	4.6	8.7	23.3	23.4
Delhi	2434	2205	2033	2144	14.3	2	2.9	3
Goa	1935	1808	2453	2069	28.1	4.1	7.5	12.4
Gujarat	2025	2073	2037	2031	8.4	3.8	4.2	4.1
Haryana	2423	2349	2446	2324	2.7	1.3	5.1	5.3
Himachal Pradesh	2343	2390	2726	2560	15.2	18.5	19.1	25.8
Jammu & Kashmir	2489	2467	2456	2423	8.6	18.3	27.2	30.6
Jharkhand	2067	2208	2209	2105	3.3	1.3	8.2	9.6
Karnataka	2073	1945	2156	2104	8.5	13.8	12.2	14.3
Kerala	1989	2142	2427	2077	29.2	9.6	10.7	16.5
Madhya Pradesh	2184	2005	2218	2159	3.9	6.8	10.1	10.6
Maharashtra	1986	2009	2216	2157	6.8	6	8.5	8.9
Manipur	2139	2453	2004	2026	2.5	0.3	2.0	1.3

Meghalaya	2008	2109	1894	1762	16.2	6.7	16.6	19.5
Mizoram	2140	2686	2184	2216	38.5	22	27.7	33.4
Nagaland	2214	2433	2089	2018	3.3	0	0.3	4.1
Odisha	2218	2182	2288	2179	2.4	4.4	15.3	19.5
Punjab	2344	2364	2541	2354	1.9	0.2	4.7	4.4
Rajasthan	2419	2316	2387	2290	6.4	3.6	4.0	6
Sikkim	1915	2195	2284	2059	32.8	17.4	16.6	23
Tamil Nadu	1928	2039	2216	2026	14.5	22.1	23.8	27.6
Tripura	1945	2039	2510	2327	16.3	16.3	20.0	29.5
Uttar Pradesh	2274	2362	2169	2140	1.8	1.5	6.2	7.7
Uttaranchal	2334	2351	2350	2453	29.7	9.1	7.8	16.5
West Bengal	2202	2283	2069	2128	4.5	2.1	5.0	7.7
India	2152	2179	2233	2158	7	5.8	9.3	11.8

Appendix Table 3: Impact of PDS on nutrition across states in India based on fiscal benefit method

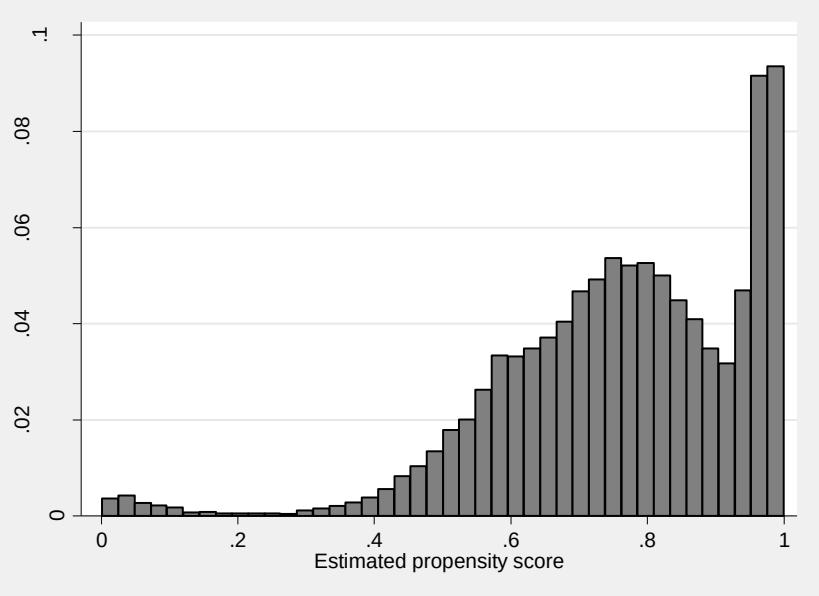
State	Average impact on nutrition deficiency ("without"-"with")				Average impact on NGI			
	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
Andhra Pradesh	11.07	12.53	22.24	27.20	2.91	3.32	5.57	5.26
Arunachal Pradesh	7.45	1.33	7.75	11.70	1.63	0.59	3.48	5.27
Assam	1.37	0.76	6.35	21.00	0.63	0.40	2.40	5.59
Bihar	0.43	-0.34	2.89	13.30	0.07	0.12	1.06	4.01
Chhattisgarh	2.31	3.44	26.80	31.50	0.38	2.21	14.10	14.05
Delhi	7.22	0.77	1.57	3.90	0.98	0.07	0.46	0.55
Goa	9.51	2.29	11.46	13.40	3.66	1.65	1.36	3.56
Gujarat	3.76	3.74	3.94	6.40	0.81	1.34	1.56	1.50
Haryana	1.55	0.82	6.52	6.40	0.13	0.26	2.23	1.62
Himachal Pradesh	2.96	9.76	15.49	22.40	0.67	1.74	2.34	3.08
Jammu & Kashmir	1.64	6.81	22.22	27.20	0.27	1.07	3.61	4.85
Jharkhand	1.49	0.56	6.24	14.50	0.23	0.55	2.92	6.21
Karnataka	3.55	14.08	17.52	21.70	1.01	5.68	5.40	5.30
Kerala	10.63	4.72	10.47	20.30	3.30	2.55	4.50	7.25
Madhya Pradesh	0.64	3.20	10.86	12.60	0.24	1.89	4.48	4.45
Maharashtra	2.48	3.35	9.39	10.90	0.54	1.71	2.28	2.98
Manipur	0.14	-0.08	0.91	1.00	0.03	0.01	0.17	0.26
Meghalaya	8.22	3.73	9.93	13.00	1.24	1.57	7.19	8.51

Mizoram	14.80	7.24	21.09	29.90	2.55	1.36	5.16	9.68
Nagaland	1.96	-0.08	-0.71	4.40	0.28	0.00	0.00	0.80
Odisha	0.83	2.35	20.48	31.70	0.16	1.30	7.30	10.78
Punjab	0.87	-0.49	6.15	6.00	0.11	0.00	1.42	0.97
Rajasthan	1.74	2.12	3.32	8.30	0.29	0.57	1.10	2.61
Sikkim	2.42	19.33	19.79	37.60	0.87	4.26	8.03	10.55
Tamil Nadu	9.07	22.02	33.76	30.50	3.15	8.18	12.45	9.07
Tripura	6.85	12.24	19.24	28.30	1.93	5.08	3.87	7.62
Uttar Pradesh	0.60	0.82	6.40	9.90	0.08	0.40	2.10	2.74
Uttaranchal	13.56	5.03	8.65	17.90	2.02	0.99	1.36	3.31
West Bengal	1.81	0.98	6.65	11.00	0.28	0.34	1.91	2.86
India	3.35	4.49	11.06	15.40	0.86	1.93	3.93	3.98

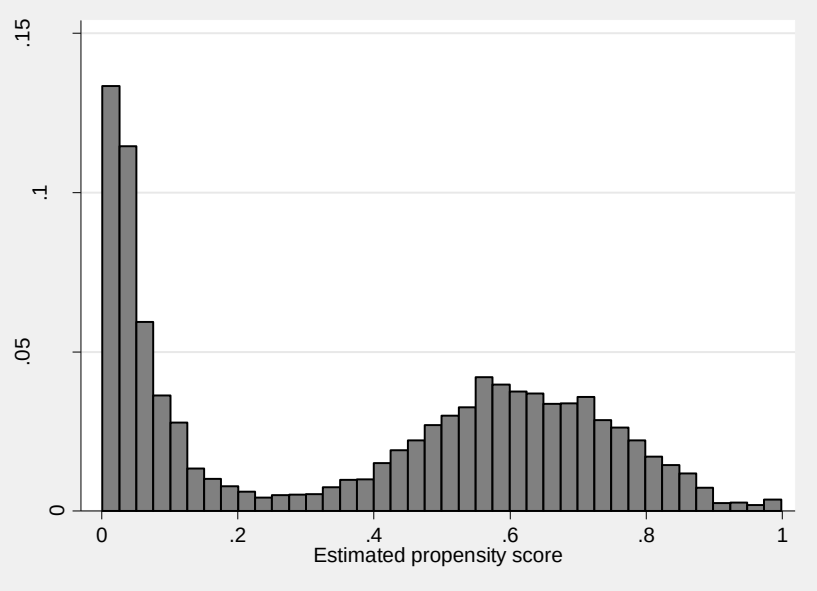
Appendix Table 4: Descriptive statistics of treatment and control groups of households

Variable	PDS Households	Non-PDS households
Sample size (No.)	15976	10060
Mean family size (No.)	5.6	5.9
Mean age of the head of the household (years)	47.1	44.6
Mean education of head of the household (years)	3.2	4.4
Average monthly per capita expenditure (Rs.)	733.0	785.2
Average monthly per capita expenditure on food (Rs.)	430.4	468.6
Average monthly expenditure on food from PDS (Rs.)	141.5	0.0
Average land owned by the household (ha)	0.32	0.37
Average land cultivated by the household (ha)	0.28	0.33
Share of households not owning any land (%)	8.6	14.4
Share of households possessing ration card (%)	100.0	56.6
Share of ration card possessing households with Antyodaya card (%)	13.4	2.7
Share of ration card possessing households with BPL card (%)	67.7	17.8
Share of ration card possessing households with other types of card (%)	18.9	79.5
Share of households with male head (%)	86.2	89.8

Share of households belonging to SC/ST caste (%)	45.7	36.9
Share of households belonging to rural areas (%)	64.1	52.0



Appendix Figure 1: Histogram of propensity score of PDS housholds



Appendix Figure 2: Histogram of propensity score of non-PDS housholds