WP-2015-015

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June 2015
http://www.igidr.ac.in/pdf/publication/WP-2015-015.pdf

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Abstract

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Keywords: Consumer Subsidy; Nutrition; Program Evaluation; Hunger; India

JEL Code: I38; H31; H43; H53; Q18.

Acknowledgements:

The author is grateful to S. Chandrasekhar for helpful advice and useful suggestions. This article has benefited from discussions with Sripad Motiram and comments on the draft by Sudha Narayanan and Subhro Sarkar. Comments and suggestions from various participants at the 4th Annual LCIRAH Research Conference: Agri-food policy and governance for nutrition and health 3-4 June 2014, Birkbeck College, London has also been valuable in improving the quality of work. Funding for this research came from the initiative "System of Promoting Appropriate National Dynamism for Agriculture and Nutrition (SPANDAN)" and is gratefully acknowledged. The initiative is housed in IGIDR and is supported by Bill & Melinda Gates Foundation. Any remaining errors are author's own. Usual disclaimer applies. Email: andaleeb@igidr.ac.in.

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1. Introduction

Growth in income although an essential driver of improved nutritional outcomes, has proved to be insufficient in ensuring a decline in hunger and malnourishment (FAO, 2012). Widespread hunger manifests itself in insufficient food intake and poor diet quality which results in malnutrition and mortality. In order to improve nutrition of the poor, consumer food subsidies are an important policy instrument in many low income countries. Social protection measures such as the food assistance programs have a crucial role to play in promoting greater nutrient intake and hence the overall nutrition (Lentz & Barret, 2013). The provision of staple food at subsidized prices not only increases access to food to the beneficiaries but also provides them an implicit income transfer which is difference between the open market and subsidized price for every unit of the food item purchased. Whether this gain in income would translate into improved nutrition has been a much debated issue, although the empirical evidence is fairly limited. Theoretically, price subsidies would have a positive effect on nutrition if the income gain is spent on the consumption on more nutritious items. On the other hand, if households substitute away from the less costly staple food items towards those which are tastier but less nutritionally dense, consumer subsidies would lead to a decline in the nutrient intake and hence overall nutrition. Using data from a randomized field experiment in China, Jensen & Miller (2011) found no evidence of the consumer price subsidy on nutrition.[1] In fact, households which are provided the food subsidy substitute away from the staple food towards those food items which are expensive sources and low on nutrient leading to a reduction in the calorie intake and other important vitamins and minerals. Also in the In the case of China, Shimokawa (2010) finds that consumer subsidies have an asymmetric effect on nutrient intake. While an increase in consumer food subsidies positively affects the total energy intake, removal of the subsidies leaves the energy intake unaffected.

In many developing countries like India, consumer food subsidies are a common form of nutritional assistance. The government of India provides subsidized foodgrains to the poorer households under its Public Distribution System (PDS) which is amongst the largest food security

[1] Based upon the results from their randomized field experiment, they also caution against any generalized interpretation of the relationship between consumer food subsidies on nutrient intake. They state that the impact of consumer food subsidy on nutrient intake would depend upon how households value this marginal implicit income transfer, which in turn would depend upon the current income level and dietary preferences of the household. A household living below the subsistence level may spend more on food while those above the basic minimum standard of living may not spend the extra income on food.

programs in the world. How consumer subsidies through PDS impacts overall nutrient intake and diet quality has been an issue of lively debate in India. Evaluation studies on the link between PDS and nutrient intake have come up with contrasting results. One of the earlier studies evaluating the effectiveness of PDS was by Kochar (2005). She looked at the impact of the move from a universal PDS to a scheme targeted towards a poorer population in 1997. With a targeted PDS, poorer population was to be provided higher consumer subsidies. She used this variation over time to study how it impacted calorie consumption. She found that greater income transfer through the PDS did not lead to greater calorie consumption for the targeted households.

In recent years, there has been a revival of the PDS in India with the Indian state governments taking various measures to improve delivery and coverage of the PDS. The average monthly consumption of rice from PDS increased from 4.1 kg to 7.7 kg per household between 2004-05 and 2011-12. Similarly, the consumption of wheat increased from 1.5 kg to 3.5 kg during this period. The resultant increase in the average income transfer to the households has been from Rs. 31.10 in 2004-05 to Rs. 85.21 in 2011-12. This exogenous increase in the consumer subsidy and the resultant income transfer as result of the improvements in the PDS delivery system give us an ideal setting to evaluate the link between consumer subsidy and nutrient intake. Kaushal and Muchomba (2011) study whether this improvement in PDS led to greater consumption of nutrients. They find no significant relationship between higher nutritional intake and PDS participation. Krishnamurthy et. al. (2013) on the other hand find that the improvements in the PDS delivery system in Chhattisgarh did lead to higher nutrient intake and diet quality.

This paper concentrates on the state of Odisha which is amongst the poorest states of India suffering from "alarming" levels of hunger (Menon et. al. 2009). Even within Odisha, there are sharp differences in the extent of food security between the different regions: costal, southern and eastern (World Food Program & Institute of Human Development, 2008). The Kalahandi-Balangir-Koraput (KBK) region which consists of 8 districts lying in the southern part of Odisha has historically been found to be suffering from chronic poverty, hunger and distress migration (Parida, 2008). Recognizing the poor nutritional indicators and poverty in the KBK region, the government decided to move away from PDS targeted towards the poor towards a universal PDS in these districts of Odisha in 2008. This led to differential levels of income transfer across these two regions of the state. In the KBK region, income transfers were higher than the non-KBK

districts with a targeted scheme. We exploit this variation in the income transfer over time across the KBK and non-KBK regions of Odisha to evaluate the link between consumer subsidies through PDS and nutrient intake.

While doing so, this paper makes the following contribution. Firstly, it provides evidence on the role of publicly provided assistance program in improving the nutrient intake and diet quality in a state with low level of economic development and regional disparity. Secondly, it underscores the importance of publicly provided food transfers in reducing nutrient inadequacy. Thirdly, this paper also contributes to the debate on targeted versus universal food security scheme by presenting insights from a natural experiment of universal PDS existing in one region while a targeted is in place in another region of the state. When analysing the impact of PDS on the intake of nutrients, the focus of this paper goes beyond the total energy intake as measured through the consumption of calories. In addition to calories, two major macro-nutrients, viz. protein and fat are also accorded equal attention. Since for improved nutritional and health outcomes, the quality of diet is equally important, this paper also focusses on the dietary composition.

This paper is organized in the following way. Section 2 provides a background on the revival of PDS, its relevance for the households in KBK districts and the existing evidence on the link between PDS and nutrient intake. Section 3 discusses the existing evidences on PDS and nutrient intake followed by a description of the data and the summary statistics in section 4. Econometric methodology and the identification strategy is discussed in section 5. Results are presented in section 6 and following section concludes the analysis.

2. Background

India's PDS has attracted criticism from large quarters for its failure to reach the poor and escalating costs of operation. According to the Performance Evaluation Report of the Planning Commission of India (2005), PDS has neither been able to enhance its reach to the poor nor could it reduce the fiscal burden. On account of rejuvenated efforts by the various state governments led by a combination of effective delivery and improved monitoring mechanism, there has been a

marked improvement in the performance of PDS in recent times[2]. Not only has there been an expansion in the coverage of PDS, the share of grains as consumed from the PDS has increased.

Odisha has been a front-runner in terms of the restructuring the PDS (Aggarwal, 2011). The government of Odisha also made PDS more attractive by reducing the subsidised price of foodgrains. Since 1997 when PDS became a targeted scheme in India, it focussed on the poorer households. Foodgrain entitlements and the price to be charged were different for the poor and non-poor households. Ration cards were distributed classifying them as BPL (Below Poverty Line) and APL (Above Poverty line) households. In 2000, another category of ration cards was included under the Antyodaya Anna Yojana (AAY) for the poorest of the poor households. Owing to poor nutritional status in the KBK region of Odisha, the difference between the APL and BPL households was removed in the KBK districts in August, 2008. Now, all the households living in the KBK districts were eligible for the subsidised rice through PDS. This led to an increase the number of beneficiaries from approximately 30 lakh to 55 Lakh (Wadhwa, 2011). Extra allocation for the increase in the number of beneficiaries has been made by reducing the BPL quota from 35 kgs. to 25 kgs. for them.

2.1 Poverty and nutrition in Odisha

On major development indicators, Odisha is similar to the most backward regions in the world. As per the official poverty line figures, 17.29 percent of the urban and 35.69 percent of the rural population was found to be poor in 2011-12. India State Hunger Index, 2008 reports Odisha to be suffering from "alarming" level of hunger (Menon et. al., 2009). High level of food insecurity is evident in the form of higher mortality and under-nutrition, especially amongst the scheduled tribes (STs) and the scheduled castes (SCs). Against the overall 43 percent of the children being underweight in the state, the share of the scheduled tribes (STs) and (SCs) was found to be much higher at 59 percent and 59.4 percent respectively (World Food Program & Institute of Human Development, 2008). While poverty and poor nutritional outcomes are correlated, the situation in Odisha is compounded by a multitude of other problems such as spatial disadvantage, social identity and the influence of naxal violence. This has led to considerable disparity within the state- across social groups and regions.

[2] For a detailed description of the various state government initiatives, please refer to Khera (2011)

2.2 Regional disparities and the KBK districts

A key feature of the poor economic development in Odisha is the persistent regional disparities. Districts along the eastern ghats with a higher share of tribal population are most food insecure (World Food Program & Institute of Human Development, 2008). Coastal Odisha performs better compared to rest of the state while the districts lying in the eastern ghats districts are the most deprived ones. Rural poverty rate in southern Odisha stands highest at 48 percent followed by the northern (40 percent) and coastal regions (21 percent)[3]. The KBK region consists of 8 districts lying in the southern part of Odisha (Figure 1)[4]. These districts in the KBK region are culturally and linguistically homogeneous and constitute 30.59 percent of the total geographical area of the state. Agriculture remains the primary occupation in these districts with a majority of the families being engaged as agricultural labour (Census of India, 2011). These districts have historically been found to be suffering from chronic poverty and distress migration (Parida, 2008). KBK region did attract a lot of attention ever since the news of starvation death from there came out during the mid '80s. Agriculture which is the primary source of livelihood in the KBK region is highly underdeveloped owing to vulnerability to natural calamities (Shah et. al., 2007). Droughts and floods are common in this region and the irrigation facilities are unevenly distributed. This often leads to wide fluctuations in the agricultural production. Another feature of the KBK districts is the larger proportion of SC and ST households. In districts like Rayagada, Nabarangapur, Koraput and Malkanagiri close to 70 percent of the households either belong to the SCs or STs. Lack of inadequate infrastructure such as road connectivity also acts as a major constraint. Forest cover in the region is also vulnerable to degradation on account of intensive use, shifting cultivation and mining. A combination of these factors makes the population in the region extremely vulnerable to any kind of economic shock.

To moderate the exposure and vulnerability of the households to such adverse economic shocks, the government has allocated large amount of money for various social protection measures in the

[3] Author's calculations using the nationally representative National Sample Survey Organisation (NSSO) data.
[4] BK region comprised of the 3 districts- Kalahandi, Bolangir and Koraput till 1992-93 when they were re-organised into eight districts namely- Malkangiri, Koraput, Nabrangpur, Kalahandi, Rayagada, Nuapada, Balangir and Sonepur. Koraput, Malkangiri, Nabarangpur, Rayagada and Kalahandi are part of the Eastern Ghats which are hilly and have a large forest cover. Balangir, Nuapada and Subarnapur districts are a part of the central tablelands, and have a more varied topography in the form of plain agricultural lands, hills and rolling uplands.

KBK region[5]. In spite of that, districts in the KBK region continue to figure amongst the poorest districts in the country as identified by the Planning Commission (Kujur, 2006). Programs to promote food security were initiated which aimed at providing food throughout the year for the old and those living below the poverty line. Cooked meals made from the locally procured nutritious vegetables were to be provided to the beneficiaries through the Anganwadi Centres (World Food Program & Institute of Human Development, 2008). It was expected to help increase intake of the required minerals and vitamins in addition to the calories. National Human Rights Commission has found strong evidence of malnutrition to persist in the KBK region despite the implementation of these welfare schemes. Failure of Public Distribution System (PDS) has been cited as a major reason for high level of undernutrition in this region.

Figure 1: Odisha and KBK districts

[5] Long Term Action Plan (LTAP) for the KBK region in 1993 and another a Revised Long Term Action Plan (RLTAP) in 1998-99 was prepared in the objective of mitigating drought and poverty alleviation, but these schemes were not much of a success.

3. Existing evidences on the link between PDS and nutrition

The provision of staple foodgrains at subsidised prices as provided through the PDS are important in increasing the access to food and ensuring basic minimum level of energy intake. Almost half of the household calorie intake from staple foodgrains in India comes from the PDS (Ray, 2007). In spite of the importance of PDS in total nutritional intake in the diet, its impact on overall nutritional intake and outcomes is not well founded in the literature. In terms of impact of PDS on child health outcomes, the only research paper that exists is by Tarozzi (2005).[6] Rest of the papers look at the link between PDS and consumption of calories, protein and fat and come up with contrasting results.

Foodgrains provided through PDS affects the nutritional intake of the households in direct and indirect ways. Providing foodgrains at subsidised rates to households with low levels of nutritional intake directly improves their total energy intake. Food price subsidies as provided through PDS could also push households to consume more calories from other more nutritious food items which could further improve the quality of their diets. Kochar (2005) examined the outcome of greater consumer subsidy or implicit income transfer to the BPL households owing to the change in PDS from a universal to a targeted scheme in 1997. She finds that the greater wheat subsidy to the BPL households did not lead to an improvement in their overall calorie intake. Kaushal and Muchomba (2013) also evaluate the impact of the transition from universal to a targeted PDS on the nutritional intake using nationally representative data for the period 1993-94 and 2009-10. While the sample of states in Kochar (2005) was restricted only to the wheat consuming states, Kaushal and Muchomba (2013) including the rice consuming states as well since the states which have performed better in terms of providing foodgrains have been the rice consuming ones. Both the results though are quite similar. There is a negligible to negative effect of the greater consumer subsidy from PDS on total calorie intake. The contribution of wheat and rice, which are provided through PDS as a source of calories have increased but the contribution of coarse cereals and other more nutritious food items such as pulses, eggs, fish and meat has been unaffected. Contrary to these earlier studies, evaluating the PDS reforms in the state of Chhattisgarh, Krishnamurthy et. al (2013) find that PDS reforms have not only increased the intake of calories, but improved the

[6] It focuses on the link between child malnutrition and PDS. He finds that a sudden reduction in the foodgrains subsidy as provided through PDS has no impact of child nutrition as measured by weight-for-age, casting doubt on the ability of the PDS to provide nutritional security.

quality of diet as well. Household diets have a greater share of calories from pulses and other animal-based proteins.

The estimation methodology as adopted in Kochar (2005) and Kaushal and Muchomba (2013) have their limitations. Kochar (2005) compares the change in nutrient intake of the poorer households after PDS became a targeted scheme. But, the baseline survey which she uses does not have information on whether the household was officially classified as poor or not. Based upon certain observable characteristics of the household, Kochar (2005) estimates the probability of a household being poor. Jensen & Miller (2011) argue that such an identification of the poor households is incorrect. Incorrect identification of poor and nonpoor households may bias the result towards finding a statistically insignificant relationship between nutrient intake and consumer food subsidy. Kaushal & Muchomba (2013) encounter a similar problem. In the absence of any identification of the poor households in the survey they used, they also use a regression method to arrive at the predicted probability of a household being poor. Recognizing the impreciseness of their identification method, they drop those households from the sample with monthly per capita expenditure (MPCE) less than the median to ensure a reasonable comparison. Their method suffers from some arbitrariness. Restricting the sample reduces the number of observation and leads to a loss of predictive power. The limitations of Kochar's (2005) study, viz. the calculation of the probability of being a poor household, is also valid here. Another point worth noting here is that these evaluation studies use data for the period when the amount of foodgrains consumed through PDS was extremely low for most states. Krishnamurthy et. al. (2013), on the other hand focus on the state of Chhattisgarh which underwent large scale expansion of PDS during 1999-00 and 2004-05. Using the difference in difference methods with the districts in the neighboring state of Chhattisgarh as the control group, Krishnamurthy et al (2013) find a substantial rise in the importance of PDS as a source of calories and it facilitated an improvement in diet quality of the households.

4. Data and Descriptive Statistics

Data used in this paper comes from the nationally representative consumer expenditure surveys (CES) as carried out by the National Sample Survey Organization (NSSO). Two rounds of the data constituting 3819 and 2973 rural households in Odisha for the years 2004-05 and 2011-12 respectively is used here. The survey collects household level information on the quantity

consumed of a range of food and non-food items and the expenditure incurred on them in the last 30 days[7]. Quantity and expenditure information on the items consumed from PDS like rice, wheat, sugar and kerosene is also collected as a part of the surveys. These surveys also contain information on the monthly per-capita expenditure (MPCE) and other socio-economic characteristics of the households which includes their geographical location, social group, religion, composition of the household, type of ration card held and the durable goods possessed. The sample design used in these surveys makes it representative of the districts for the rural and urban areas seperately (Chaudhuri and Gupta, 2009). The impact of PDS is quantified using the cross-sectional variation over time. The 2004-05 survey acts as a baseline since a universal PDS in Odisha came into being in 2008 while the information from 2011-12 survey captures the post-intervention outcomes. The sample is restricted to rural areas of Odisha since the PDS revival has been more effective in the rural areas.

We convert the consumption of food items into its nutrient content (calorie, protein and fat) using the nutrient content of Indian food items according to Gopalan et al (1991).[8] There was a slight change in the survey questionnaire over time. The 2004-05 survey did not take into account the consumption of free meals. Though free meals constitute a very small part of the daily intake, nutrient intake from free meals has been removed for the sake of comparability here. To look at the source of nutrients and the variety of food items in the diet, food consumption is sub-divided into the following six groups: cereals, pulses, dairy products, eggs, fish and meat, fruits and vegetables, edible oils and other food items.

4.1 Descriptive Statistics

Per-capita expenditure in rural Odisha is lower than the all-India average. Within Odisha, KBK region has a lower MPCE as compared to other districts. In 2004-05, monthly per-capita expenditure in the KBK districts of Odisha in stood at Rs. 294.95 as compared to Rs. 415.32 in the other districts at 2004-05 constant prices. KBK districts continue to have a lower level of

[7] There were two survey schedules used in 2011-12 based upon the 30 days and 7 days recall period. This article uses the 30 days schedule for the sake of comparability over time.
[8] Nutrient conversion charts by Gopalan et al (1991) are also used by the Government of India in their calculations.

expenditure in 2011-12 as well but the gap between MPCE of the KBK and non-KBK districts has narrowed down in 2011-12 as compared to 2004-05.

Looking at the distribution of ration card across the state, we find that 33 percent of the households in 2004-05 did not have a ration card which declined to 28 percent in 2011-12 (Table 1). It is to be noted that in spite of a reduction of the number of the households with no ration card in the districts belonging to the KBK region, a sizable share of the households (27.07 percent) lies outside the ambit of PDS with no ration card.[9] Share of households with AAY and BPL cards in Odisha has gone up over time while the households with the APL card have come down. This is more pronounced in the KBK districts. In the non-KBK districts, there has been a reduction in the proportion of households with APL card while the share of BPL and AAY card holding families increased.

Table 1: Household profile by types of ration card possessed (in %)

	Odisha		KBK Districts		Non-KBK Districts	
	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
AAY	1.99	5.49	2.71	6.24	1.85	5.36
BPL	42.57	47.86	48.94	58.08	41.29	46.04
APL	22.41	18.22	7.41	8.61	25.42	19.93
No Card	33.02	28.43	40.95	27.07	31.43	28.67

AAY: Antayodaya Anna Yojana; BPL: Below Poverty Line; APL: Above Poverty Line

Source: NSS 61 and 68

With the expansion of PDS after 2004-05 and improved delivery system as discussed above, there has been a substantial increase in the quantity as well as share of rice consumed from PDS.[10] In the KBK districts, average household consumption of rice from PDS has increased from 8.9 kgs. to 20 kgs. per month (Table 2). In the non-KBK districts, there has been an almost five-fold increase from 3.3 kgs. to 15.1 kgs. Percentage increase in the consumption of PDS rice for the AAY households is lower as compared to the BPL households since the emphasis on targeting the poorest of the poorest households has always been there. Similarly, BPL households in the KBK districts consumed a larger amount of rice from PDS as compared the other districts and hence the

[9] This can be attributed to the administrative difficulty of BPL card issuance or the households self-selecting themselves out of it.

[10] The share of rice from PDS in rural Odisha has increased from 7% to 31% during 2004-05 and 2011-12 (Rahman, 2014)

scope for improvements in the delivery was higher in the latter. Still, we see observe a doubling of the consumption of rice from PDS in the KBK districts from the BPL households. With the removal of any distinction between the APL and BPL card holders in the KBK district, the average consumption of rice from PDS has gone from 6.4 kgs. in 2004-05 to 21.9 kgs. in 2011-12.

Table 2: Average rice consumed in a month by the households from PDS (kgs. per housheold)

	KBK		Non-KBK	
	2004-05	2011-12	2004-05	2011-12
AAY	24.8	31.9	26.4	32.5
BPL	14.1	27.6	6.5	27.9
APL	6.4	21.9	0.6	2.2
No Card	2.1	0.2	0.1	0.3
Total	8.9	20.0	3.3	15.1

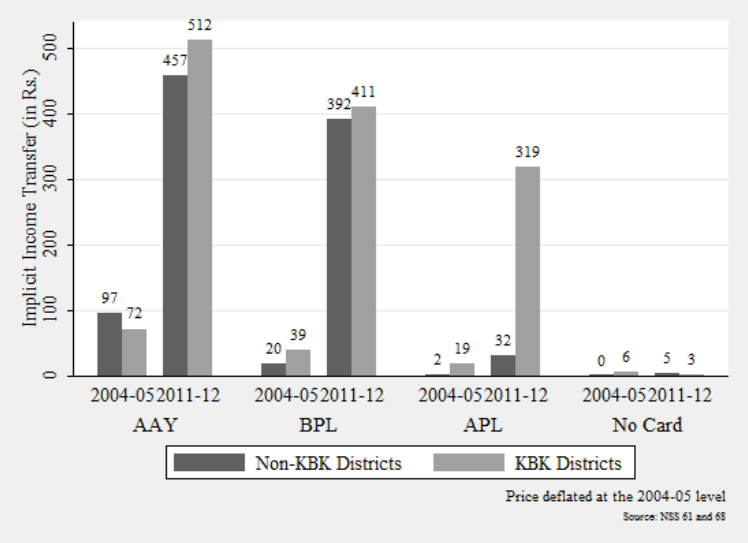
Source: NSS 61 68

The turn-around of PDS coincided with a period of sudden rise in the price of food products including rice. With the government further reducing the PDS prices of rice during this period, the implicit income transfer or the consumer subsidy to the consumers has seen a large increase. Income transfer to the households has generally been calculated as the difference between the open market and PDS price multiplied by the quantity of subsidised rice. If the market price of rice is, say p_m and it is sold at a price p_d at the PDS outlet, the price differential is $(p_m - p_d)$. Upon consuming the quantity, q from the PDS, the implicit income transfer or the value of consumer food subsidy stands at $(p_m - p_d) * q$ rupees. Since the data on market prices is unavailable in the surveys, unit values are used as a proxy for price. Unit values for each item can be calculated by dividing expenditure incurred upon it by the quantity consumed. Though unit values are not exactly the prices, they act a suitable proxy for prices (Deaton, 1997).[11] Increase in the implicit income transfer for both the AAY and BPL card holders is clear from Figure 2. Though the increase is similar for both the KBK and non-KBK districts, there is a higher gain in the former on account of a substantial gain to the APL households as well. For the APL households in the non-KBK region, there is a negligible increase in implicit income transfer while in the KBK districts, implicit

[11] Limitations of the unit values has been well-recognised in the literature. They they mask the household preference for variety, bundled quantity and geographical location amongst a host of other things. Hence, unit values are just a suitable proxy for prices.

income transfer to the APL households is close to Rs. 200, slightly less as compared to the BPL households there.

Figure 2: Average monthly implicit income transfer to the households



Average nutrient intake is lower in the KBK region of Odisha (Table 3). In 2011-12, mean per-capita daily calorie intake was 1819 kcal in districts belonging to the KBK region as compared to 2046.5 kcal in non-KBK region. Similar pattern exists for fats and protein. For households differentiated on the basis of ration cards, those with the APL card are better with respect to others in terms of nutrient intake. AAY card holders in the KBK region consumed a lower amount of fat than the BPL households, but their daily intake of calorie and protein is higher. For the non-KBK districts, it is difficult to differentiate between the AAY and BPL households. In Table 4, we compare changes in the average nutrient intake over the two survey rounds using the *t-test*. Since, the AAY households constitute a small proportion of our sample and they are also poor, we include them in the BPL category here. Table 6 reports the intake of not only the major macronutrients-calorie, protein and fat but also the calorie sources for the major food groups as described earlier. Overall, there is an increase in the intake of calories. But, it is not found to be statistically significant. For the BPL households, this increase is not only larger but statistically significant (Table 4). Increase in consumption of calories is larger for the BPL households belonging to the KBK region (237.3 kcal as compared to 45.1 kcal in the non-KBK region). In the KBK region, though there is an overall increase in the calorie intake for the BPL as well as the non-BPL

households, it is not significant for the latter. In the non-KBK region, calorie intake has increased only for the BPL households while there is a decline for the other category.

Trends in the consumption of protein are broadly similar to that of calories, but the intake of fat has increased for all household categories irrespective of which region of Odisha they belong to. Increase in the consumption of fat is higher for the BPL households across the regions. One possible reason could be their low level of fat intake earlier. Sources of calorie is an important barometer to measure the variety of diet which is an important indicator of diet quality. Since cereals are the staple diet in the region, a shift away from them to other items would signal an improvement in diet. The intake of calorie from cereals has declined over the period for both the poor and non-poor households in the non-KBK districts but the opposite holds true for the KBK region. In terms of calorie from non-cereals, there is an across the board increase. Pulses as a source of calories has increased in importance together with the dairy products and edible oils for the households (Table 6).

High level of nutritional deficiency in the tribal belt of Odisha has been highlighted by Jena (2008). The households especially, children in the region are consuming less than their recommended dietary allowance (RDA) as advised by the Indian Council for Medical Research (ICMR) which increases their vulnerability to diseases and infections. RDA varies according to the gender, weight and nature of work of an individual. In the data used here, we do not observe individual characteristics like their weight and the nature of work. We construct the actual nutrient intake for each household and divide it by the consumer unit of the households to arrive at the adult equivalent RDA of calorie, fat and protein per adult equivalent.[12] There is almost no change in the share of households falling below the RDA norms for calorie in the KBK districts over time (Table 5). It has declined from 89.93 percent in 2004-05 to 89.01 in 2011-12). Except for the lowest MPCE quartile in the non-KBK districts, the ratio of calorie to RDA has come down. There is a secular decline in the share of households below their recommended protein intake for all quartiles in the KBK districts while the opposite holds for other districts in Odisha. This is contrary to the larger all-India picture where calorie and protein consumption has declined over time. The National Nutrition Monitoring (NNMB) Report, 2012 finds a similar decline in the case of Odisha.

[12] The appendix describes how we arrive at the household level RDA within the constraints of data availability. Weights for the consumer units are also provided in the appendix

This anomaly may be a reflection of the extremely low of nutrient intake in the KBK region. Deaton & Dreze (2009) have argued that the decline in the energy intake is not a worry since there has been a change in nature of occupation which require less manual labour. An improvement in the sanitation and health requirement has further lowered nutrient requirements. Their argument might not hold for the rural KBK districts where a majority households are still employed in agriculture and mortality remains high. In addition, the state of sanitation and water availability remains inadequate. In terms of fat intake, all households in the first and second MPCE quartiles of the KBK districts are found to be below their RDA.

Table 3: Average nutrient intake (per diem)

	AAY		BPL		APL		No Card		Total	
	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
Non-KBK Districts										
Calories (in kcal)	1945.0	2060.2	2013.6	2016.6	2246.1	2097.3	2014.0	2055.9	2076.8	2046.5
Fat (in grams)	44.5	47.7	46.8	47.2	53.9	50.7	47.9	49.6	49.0	48.6
Protein (in grams)	13.8	20.8	14.8	20.8	22.9	27.1	19.2	25.6	18.3	23.4
Non-Cereal Calories	319.7	407.8	356.1	429.9	536.2	543.8	456.9	526.0	433.6	477.6
KBK Districts										
Calories	1698.7	1800.0	1558.2	1819.9	1891.7	1950.5	1775.9	1768.9	1674.6	1819.0
Fat	37.3	42.0	36.0	42.0	44.8	46.7	41.0	41.7	38.7	42.4
Protein	9.1	14.8	10.2	17.4	16.2	22.2	15.5	20.2	12.7	18.4
Non-Cereal Calories	183.4	330.5	215.2	361.9	342.9	449.5	352.2	422.9	278.7	383.2

Note: Calorie is in kilocalories. Proteins and fats are measured in grams.
Source: NSS 61 and 68

Table 4: Difference in the mean nutrient consumption over 2004-05 and 2011-12

	Odisha			KBK Districts			Non-KBK Districts		
	All	BPL	Non-BPL	All	BPL	Non-BPL	All	BPL	Non-BPL
Major Macronutrients									
Calories	11.1	77.3***	-24.655	132.3***	237.8***	63.7	-11.9	45.1**	-42.9**
Protein	0.7*	2.0***	0.252	3.7***	5.8***	2.7**	0.1	1.1**	-0.2
Fat	5.8***	6.66***	5.929***	5.3***	7.2***	4.8***	5.9***	6.6***	6.0***
Sources of Calories									
Cereals	-40.9***	-17.6	62.9***	75.2***	91.9***	54.6	63.6***	-40.2**	-85.0***
Non-Cereals	52.0***	94.9***	38.2***	57.1**	145.8***	9.1	51.7***	85.3***	42.1***
Pulses	17.6***	22.6***	15.8***	32.2***	37.4***	30.2***	14.6***	19.1***	13.1***
Egg, Fish & Meat	1.0**	1.7***	0.9	4.1***	4.6***	4.2***	0.4	1.1*	0.2
Dairy Products	19.6***	18.0***	24.6***	13.7***	12.5***	22.4***	20.9***	19.7***	24.8***
Vegetables and Fruits	-15.8***	11.9***	-16.6***	10.1***	10.2***	14.0***	20.8***	-16.0***	22.5***
Edible Oil	44.7***	47.6***	45.8***	47.9***	54.3***	46.1***	44.2***	46.4***	45.3***
Other Food Items	-15.0**	16.8***	-32.3***	-51.1**	26.8**	-108.0**	-7.6	14.8***	-18.8*

Note: ***, ** and * represent significance at 1, 5 and 10 percent respectively. BPL includes AAY households as well.
Source: NSS 61 and 68

Table 5: Percentage of households below their RDA by MPCE deciles

MPCE Deciles	Calories				Protein				Fat			
	KBK Districts		NonKBK Districts		KBK Districts		NonKBK Districts		KBK Districts		NonKBK Districts	
	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
Bottom	100	99.42	95.89	95.98	99.08	95.76	87.43	89.34	100	100	99.93	99.22
2	99.69	94.95	80	83.89	97.26	81.2	67.45	66.88	100	100	98.82	89.62
3	85.55	81.62	63.95	75.82	78.67	73.73	43.53	52.74	97.65	92.63	95.88	72.19
Top	74.7	80.31	38.63	55	61.92	67.45	17.01	31.31	80.91	69.56	57.57	39.16
Total	89.93	89.01	69.61	77.66	84.16	79.49	53.84	60.05	94.6	90.5	88.05	75.03

Source: NSS 61 and 68

5. Econometric Methodology

We draw upon the methods in the existing literature on impact evaluation to quantify the effect of a universal PDS the KBK region of Odisha on nutrient intake and diet quality. The setting here is a "natural experiment" with districts belonging to KBK region being exposed to the treatment while other districts are not. Hence, in the parlance of evaluation methods, KBK region— with a universal PDS— is our treatment group while the rest of Odisha is the control group. A difference-in-difference (DID) approach could be employed with the 2004-05 survey as the baseline.[13] The foremost assumption while identifying any treatment or causal effect is that of unconfoundedness. It says that conditional on a set of observed covariates, there are no unobserved factors which affect the potential outcomes (Imbens and Wooldridge, 2009). In a non-random experiment, this assumption is difficult to hold. Selection or participation in any program is hardly based upon all the factors which are observed to the researchers. This induces selection bias into program evaluation.

The present case is of purposive program placement by the government. Universal PDS was declared in the KBK region based upon its history of poor nutritional outcome. Hence, the selection of districts into the program (here, PDS) is not random. Benefit of the DID approach is that takes into account this potential selection bias problem by controlling for the initial conditions of the control and treatment groups that might lead to non-random program placement. It compares the control and treatment group before and after the intervention. The difference between the observed mean outcomes for the treatment and control group after the intervention is the DID estimate. In a DID set-up, mean outcome of the treatment group before and after the intervention is compared. Assume Y_0^T and Y_1^T represent the mean outcome of the treatment group before and after the intervention respectively. Similarly, let, Y_0^C and Y_1^C be the respective mean outcome of the control group post and prior to the intervention. Then, the DID estimate is given by:

$$\tau_{DID} = E(Y_1^T - Y_0^T | T = 1) - E(Y_1^C - Y_0^C | T = 0) \quad (1)$$

Here $T = 1$ implies the treatment while $T = 0$ stands for no treatment.

[13] Krishnamurthy et. al. (2013) while evaluating the PDS reforms in Chhattisgarh use the neighbouring districts of Chhattisgarh as their control group while the whole of the Chhattisgarh acts as the treatment group.

Double differencing as shown in (1) removes that bias in the post-intervention comparison between the treatment and control froups which may be due to any permanent differences between them or any differential time trend unrelated to the treatment assignment. Hence, the endogeneity of treatment, if any is taken care of (Imbens and Wooldridge, 2009). The DID approach has its distinct advantages over the other methods of program evaluation especially in the case of repeated cross-sectional datasets and when the selection takes place on unobservable factors. Firstly, it helps us avoid the problem of self-selection. Since the assignment of treatment and control is non-random, there are unobserved factors as well which lead to program placements. The DID estimator allows for this unobserved heterogeneity by assuming that it is time invariant. It is also known as the parallel trend assumption which implies that in the absence of a treatment, both the control and treatment group would follow the same trend, even though the mean outcome may be different. Hence, any bias that is there as a result of unobservable factors cancels out.

5.1 Identification Strategy

The DID estimate can be captured in a regression framework using the following specification:

$$Y_{idt} = \beta T_d + \tau_{DID}(T_d * t_i) + \gamma t_i + \lambda X_{idt} + \mu_d + \varepsilon_{idt} \qquad (2)$$

Y_{idt} is the observed outcome, T_d is the dummy for treatment region and t_i is the time dummy. The coefficient τ_{DID}on the interaction term between time and treatment dummy is the DID estimate. The other household level factors X_{idt}can also be controlled for in the regression in addition to the district fixed effects, μ_d.

To make sure that the effect captured here is not an artefact, *placebo tests* are used. It implies that in the absence of a universal PDS in KBK, the outcomes of interest would have been the same in both the KBK and non-KBK districts. In other words, the DID estimate, τ_{DID}would be insignificant. This is checked through running the same regression using data from an earlier period. It is called the *falsification test* or the *placebo test* since we check whether in the absence of an intervention, we do not observe a significant change. Non-KBK districts are the closest one would get to a treatment group for the KBK regions. If we take the other neighboring states or their districts which are also poor, the bias may not go away. This is so since the neighboring states

of Chhattisgarh and Jharkhand too have had an improvement in the PDS but the degree of improvement may be different. Hence, we stick to the non-KBK districts as the control group.

It has been widely recognized that the treatment effects of an intervention are not homogeneous (Ravallion, 2007; Heckman et. al., 1998). Average treatment effects as reported by the DID estimate does not take into account the heterogeneity of the program effect. Hence, results from a quantile DID are also reported in order to understand the differential treatment effects across the distribution.

To further check whether the households with access to PDS have consume a more nutritious basket in the KBK districts of Odisha, we can take the households without any ration card in the KBK as the alternative control group. Households with a ration card (AAY/BPL/APL) are the treatment group. This is justified since the households without any ration card have per-capita expenditure and other characteristics similar to the other households in this region. Also, the percentage of households without a ration card constitutes a substantial proportion of the population as shown in Table 1.

Another important question which this paper attempts to investigate that whether the nutrient intake of BPL household has increased in the KBK region following the shift to a universal PDS. It has been argued that a universal PDS in place of a targeted one would increase welfare of the BPL households since the errors of targeting would reduce (Himanshu and Sen, 2011; Kotwal et. al., 2011). This broadly follows from the political economy argument that effectiveness of any public program depends upon the benefit it bestows upon the non-poor. The better off sections of the population have a greater political support and voice and hence any public program targeted specifically at the poor runs the risk of reduced political support (Besley and Kanbur 1990; Gelbach and Pritchett 2000; Gelbach and Pritchett 2002). It implies that a universal program is more likely to succeed than the one targeted only at the poor in an unequal society. To ascertain whether the above argument holds, a triple DID regression is employed wherein the time dummy, t_i is interacted with the treatment dummy (T_d) for the KBK region here and a dummy for the households with a BPL card (BPL_i). Econometric specification of a triple DID regression is of the following form:

$$Y_{idt} = \beta T_d + \tau_{DID}^{tr}(T_d * t_i * BPL_i) + \gamma t_i + \delta(T_d * BPL_i) + \theta(t_i * BPL_i) + \lambda X_{idt} + \mu_d + \varepsilon_{idt} \qquad (3)$$

$$\tau_{DID}^{tr} = E\left(Y_{1,BPL}^{T} - Y_{0,BPL}^{T} \middle| T = 1\right) - E\left(Y_{1,BPL}^{C} - Y_{0,BPL}^{C} \middle| T = 0\right) - E\left(Y_{1,oth}^{T} - Y_{0,oth}^{T} \middle| T = 1\right) \quad (4)$$

The triple DID estimator, τ_{DID}^{tr} gives a measure of the move towards universal PDS in KBK districts on its BPL population. By subtracting the change over time for the BPL households in the non-KBK region, i.e. $E\left(Y_{1,BPL}^{C} - Y_{0,BPL}^{C} \middle| T = 0\right)$ and other non-BPL households in KBK districts *viz.* ($E\left(Y_{1,oth}^{T} - Y_{0,oth}^{T} \middle| T = 1\right)$ from changes in BPL households belonging to the KBK districts, τ_{DID}^{tr} informs us of the true impact of the removal of APL-BPL difference in the KBK region upon the BPL households.

The outcome variable in the above econometric specification are the major macronutrients- calorie, fat and protein in daily per-capita terms. In addition to that we look at the amount of calorie consumed through different food source- pulses, dairy products, eggs, fish and meat, vegetable and fruits, edible oils and others.[14] It is essential to control for the socio-economic and other demographic characteristics since the nutritional status of the households are not invariant to them. Chronic energy deficiency is found to vary across religions, social groups, occupation of the household head, literacy, income and landholding pattern (National Institute of Nutrition, 2012). We take into account these factors while running the regressions.

We control for the household characteristics such as social groups (ST, SC, OBC and others), primary occupation of the household (self-employed in agriculture, self-employed in non-agriculture and others), religion (Hinduism, Islam, Christianity and others), size of the household, share of children in the age group of 0-6 and 7-14, land size decile class, monthly per-capita expenditure (MPCE) decile class, gender and educational attainment of the household head, sources of cooking and lighting and whether there is a salaried member in the household.

6 Estimation Results

Results from the DID regressions are presented in Table 6. Estimates as reported in column (1) were arrived at by controlling for the district fixed effects but not for the household characteristics. In the column (2), both district fixed effects and the household characteristics were controlled for.

[14] Regression uses a logarithmic transformation for the nutrient intake.

Columns (3)-(5) report results from the quantile DID regression at the 25th, 50th and 75th quantile. The results suggest that the universal PDS in KBK region has led to 8 percent increase in per-capita intake of calories. Similarly, the per-capita protein and fat-intake have increased by 8 and 10 percent respectively in the KBK districts. Controlling for the covariates and including the district fixed effects, the coefficients decline slightly but the broader pattern remains the same. Coefficients on the time dummy is positive for nutrients (calorie, protein and fat), but the KBK region dummy is found be statistically insignificant.

One can see from the column (2) that on account of a universal PDS, there has been 7 percent increase in the consumption of calories and protein while fat intake has increased by 11 percent in the KBK region. Increase in the intake of non-cereals (20 percent) is larger than that of cereals (21 percent). Since, cereals are supplied through the PDS, we expect the coefficient to be positive and significant which we do find.[15] We also find a greater gain in the consumption of non-cereals which suggests a greater diversity in the diet. Looking at the coefficients in the case of various calorie sources as the outcome variables, we find a greater consumption of calorie from pulses, animal proteins, fruits and vegetables and edible oil. There has been 42 percent increase in the consumption of pulses, 27 percent in the case of calories from eggs, fish and meat, 33 percent from vegetables and fruits and 27 percent from the edible oils. No increase in the consumption of dairy products is found. The quantile DID estimates (columns (3-5) in Table 8) suggest a greater impact on the nutrient intake for the lowers quantile.[16] There has been 44 percent increase in calories from pulses for those in the lowest quantile. This decreases monotonically as one goes up the higher quantiles. Similar is the pattern for eggs, fish and meat and vegetables and fruits.

Table 6: Difference in Difference Estimates

	Without covariates and District FEs	With Covariates and District FEs			
			Quantiles		
	OLS	OLS	0.25	0.5	0.75
	(1)	(2)	(3)	(4)	(5)

[15] Of course, we can have a negative coefficient when the outcome variable is calorie from cereals. Since, the households are consuming a greater amount of rice than earlier from PDS, a negative coefficient would be found.
[16] Impact is the same across quantiles for protein.

Macronutrients					
Calorie	0.08***	0.07***	0.09***	0.06***	0.06***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Protein	0.08***	0.07***	0.07***	0.07***	0.07***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Fat	0.10***	0.11***	0.14***	0.09***	0.10***
	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Sources of Calories					
Cereals	0.21***	0.17***	0.11***	0.05***	0.05***
	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)
Non-Cereals	0.18***	0.20***	0.23***	0.21***	0.21***
	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)
Pulses	0.47***	0.42***	0.44***	0.34***	0.33***
	(0.06)	(0.05)	(0.06)	(0.05)	(0.04)
Milk	-0.07	0.04	-0.08	-0.14*	0.22
	(0.13)	(0.10)	(0.06)	(0.08)	(0.15)
Eggs, Fish and Meat	0.30***	0.27***	0.47***	0.26***	0.17***
	(0.07)	(0.06)	(0.11)	(0.07)	(0.06)
Vegetables & Fruits	0.34***	0.33***	0.31***	0.30***	0.21***
	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Edible Oil	0.28***	0.27***	0.19***	0.17***	0.20***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
Others	0.10**	0.11***	0.17***	0.11***	0.16***
	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)

Notes: The covariates used in the estimates for columns (2)-(4) are the household social groups (ST, SC, OBC and others), household type, religion, size of the household, percentage of children in the age group of 0-6 and 7-14, land size class, gender and educational attainment of the housheold head, sources of cooking and lighting ans wether the household has a salaried member. Standard errors are provided in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6.1 Ratio of nutrient intake and the RDA

Summary statistics suggest that households in the KBK districts of Odisha fall well short of their recommended nutrient intake. To investigate whether a universal PDS in the KBK region furthered their progression towards their RDA of calories, protein and fat, we run separate DID regression

with the percentage of RDA as the outcome variable which is calculated as the ratio of current nutrient intake to the RDA multiplied by hundred.[17] Results are presented in Table 9. It suggests that the gap between the actual nutrient intake and the recommended one in the KBK region has come down by 4.94 percentage points for calories and 6.37 percentage points for protein. We do find any significant change for fat though the sign on the coefficient is positive and for the lower quantile of fat consumption, it is significant.

Table 7: DID Regression: ratio of nutrient intake to RDA

		Quantile Estimates		
	OLS	0.25	0.5	0.75
Calories	4.94***	6.55***	5.11***	5.72***
	(1.22)	(1.31)	(1.15)	(1.4)
Protein	6.37***	4.61***	6.13***	8.68***
	(1.49)	(1.24)	(1.15)	(1.41)
Fat	1.43	2.92**	1.71	2.37
	(2.58)	(1.31)	(1.50)	(2.03)

Notes: 1. The outcome variable in the nutrient intake per adult equivalent in the household divided by the RDA for each household. This ratio is multiplied by 100 for the results to be interpreted in percentage terms. 2. The covariates used in the estimation are the household social groups (ST, SC, OBC and others), household type, religion, size of the household, percentage of children in the age group of 0-6 and 7-14, land size class, gender and educational attainment of the housheold head, sources of cooking and lighting ans wether the household has a salaried member. Standard errors are provided in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6.2 Robustness Checks

To attribute this change in nutrient intake and dietary pattern in the KBK region to PDS, we use the *placebo* regressions. The regression is called as *placebo* since it uses the earlier year data when no intervention had taken place. Here, we use the 1999-2000 and 2004-05 CES data when there was no intervention in the KBK region. The absence of a statistically significant interaction term between time and the KBK dummy would suggest the improvement there was no difference between the outcome variables for the KBK and non-KBK districts. Hence, the DID estimate would be unbiased and the increase between 2004-05 and 2011-12 could be attributed to the PDS. Results from the *placebo* regressions are reported in Table 8. We found that the common trend assumption holds for the calories and protein, but not for fat. Amongst sources of calories, it holds

[17] For example, if the per adult equivalent RDA for calories is 100 kcal and the individual calorie intake is 80 kcal, it implies that the individual consumes 80% of the RDA.

true only for the dairy products. For the DID regression where the ratio of nutrient intake to RDA is outcome variable, we find no change over time in the case of calorie and protein. We do find a change in the ratio of fat intake to its RDA over time of no intervention, but it significant only at the 10 percent level.

Table 8: Results from the *placebo* DID

	Coeff	std. errors
Macronutrients		
Calories	0.01	(0.02)
Protein	-0.01	(0.02)
Fat	-0.10***	(0.03)
Non-Cereals	-0.14***	(0.03)
Source of Calories		
Cereals	-0.16***	(0.05)
Pulses	-0.37***	(0.08)
Milk	0.14	(0.12)
Eggs, Fish and Meat	-0.40***	(0.08)
Edible Oil	-0.36***	(0.05)
Vegetables & Fruits	-0.52***	(0.04)
Others	0.14***	(0.05)
Ratio of nutrient intake to RDA		
Calories	-2.72	(1.72)
Protein	-4.47*	(2.68)
Fat	-7.29	(5.63)

Notes: 1. The coefficients reported here are from the interaction terms between the earlier period 1999-00 and 2004-05 and the KBK region dummy during which no intervention took place. 2. Covariates used in the estimation are the household social groups (ST, SC, OBC and others), household type , religion, size of the household, percentage of children in the age group of 0-6 and 7-14, land size class, gender and educational attainment of the household head, sources of cooking and lighting ans whether the household has a salaried member. Standard errors are provided in parentheses. *** p<0.01, ** p<0.05, * p<0.1

One must be mindful of the *placebo* regressions when interpreting the results in terms of any causal relationship. If there has been a significant change in the outcome variables for the KBK districts over time, attributing this change to the PDS expansion would be misleading. In the present case, we find no change over the pre-intervention period for calorie and protein intake. This suggests that PDS did have an effect in increasing nutrient intake in the KBK districts of Odisha. Similarly,

improvements in the ratio of nutrient intake to RDA can be attributed to PDS. Though, we cannot say the same for the different calorie sources as their consumption pattern do not follow the same trend.

Households without ration cards as the control group

As discussed earlier, inspite of a universal PDS in KBK region, all households do not have access to it as they do not possess a ration card. Since, their characteristics are not much different from the other households in the KBK region who have access to PDS, we take the households without the ration card as an alternative control group.[18] The sample is restricted to the KBK region only and we run a DID regression. The results we found are similar (Table 9). Calorie consumption of the households which had a PDS card in the KBK districts increased by 12 percent relative to the other households. Similar increase is evident in the case of protein and fat whose consumption went up by 10 and 20 percent respectively. In terms of calorie sources, there is a significant increase in the consumption of calorie from pulses (26 percent), edible oil (24 percent) and other products (34 percent). In the KBK districts, those with a PDS card were found to be 4.94 percent and 6.37 percent closer to their recommended calorie and protein intake.

Table 9: DID estimates with no ration card in the KBK region as the control group

	DID	Std. errors
Macronutrients		
Calorie	0.12***	(0.03)
Protein	0.10***	(0.03)
Fat	0.20***	(0.04)
Sources of Calories		
Cereal	0.07	(0.07)
Non-Cereal	0.26***	(0.04)
Pulses	0.44***	(0.11)
Milk	0.27	(0.18)
Eggs, Fish and Meat	0.15	(0.12)
Vegetables and Fruits	0.02	(0.05)
Edible Oil	0.24***	(0.08)
Others	0.37***	(0.08)
Ratio of nutrient intake and RDA		
Calorie	4.94***	(1.22)
Protein	6.37***	(1.49)
Fat	1.43	(2.58)

[18] MPCE for households without any ration card is comparable to those of the APL households in the KBK region. Average MPCE for those with no ration card is Rs. 427 against Rs. 429 for the APL card holders in the KBK region. MPCE of the BPL households is much lower.

Notes: 1. The results are only for the KBK sample. Treatment group constitutes households with any ration card (AAY/BPL/APL) while the treatment group comprises those households who do not have a ration card. 2. The covariates used in the estimation are the household social groups (ST, SC, OBC and others), household type (self-employed in agriculture, self-employed in non-agriculture and others), religion, size of the household, percentage of children in the age group of 0-6 and 7-14, land size class, gender and educational attainment of the household head, sources of cooking and lighting and whether the household has a salaried member. Standard errors are provided in parentheses. 3. The dependent variables are the natural logarithmic transformation of the per-capita daily values.
*** p<0.01, ** p<0.05, * p<0.1

6.3 Triple DID estimates

Results from the triple DID approach as explained in equations (3-4) suggests that for the BPL households in the KBK region, universal PDS has not led to any significant increase in the consumption of calories, fat or protein as compared to the non-KBK region (Table 10). Though, we see that there is an increase in the consumption of calories from non-cereal food items, but the change is not significant for any specific non-cereal food group. It suggests that during the time when rapid expansion and improvements in PDS was taking place in Odisha and PDS in the KBK region was made universal, the nutritional intake if the BPL households was not found to be different across the KBK and non-KBK districts. But, when we look at the ratio of the nutrient intake to the RDA, there has been a significant increase for the BPL households in KBK district with respect to the non-KBK districts. There is 9 percentage point increase in the ratio of calorie intake to the RDA. Similarly, ratio of protein and fat intake with respect to the RDA is higher by 8.79 and 7.43 percentage points respectively for the BPL households in KBK districts.

Table 10: Triple DID estimates

	DID	std. errors
Macronutrients		
Calorie	0.03	(0.03)
Protein	0.02	(0.03)
Fat	0.07	(0.05)
Sources of Calories		
Cereal	-0.09	(0.08)
Non-Cereal	0.12***	(0.04)
Pulses	0.12	(0.11)

Milk	-0.09	(0.21)
Eggs, Fish and Meat	-0.12	(0.13)
Vegetables and Fruits	-0.11	(0.07)
Edible Oil	0.08	(0.08)
Others	0.11	(0.07)
Ratio of Nutrient Intake to RDA		
Calorie	9.07***	(2.14)
Protein	8.79***	(2.61)
Fat	7.43***	(3.14)

1. The triple DID coefficient, τ_{DID}^{tr} is for the interaction term, $T_d * t_i * BPL_i$ as presented in equation (3-4) 2. The covariates used in the estimation are the household social groups (ST, SC, OBC and others), household type (self-employed in agriculture, self-employed in non-agriculture and others), religion, size of the household, percentage of children in the age group of 0-6 and 7-14, land size class, gender and educational attainment of the household head, sources of cooking and lighting and whether the household has a salaried member. Standard errors are provided in parentheses. The estimates are arrived at controlling for the district fixed effects 3. The dependent variables are the natural logarithmic transformation of the per-capita daily values.

7 Concluding Remarks

This paper investigates the impact of the universal PDS entitlements in the KBK region on the household nutrient intake and dietary patterns. The results suggest an increase in the intake of major macronutrients and diet quality in the KBK districts. This increase can be attributed to the greater income transfer as a result of universal PDS entitlements in the region. As a result, households in the KBK districts are now getting closer to their recommended nutrient intake. Even within the KBK districts, there has been a greater increase in the nutrient intake for the households with a ration card relative to those without one. The other important result that stems from this paper is that removal of the distinction between the entitlements of the APL and BPL households in the KBK region does not necessarily improve the nutrition of the BPL households there. This suggest that greater valuation of a public program to the non-poor in KBK districts has not led to an increase the benefits accrued to non-poor. This is contrary to what has been generally argued in the literature on the political economy of any social support program.

While the focus of this paper is solely restricted to Odisha, the results have implications for the food policy in a broader context. Firstly, the findings suggest that food assistance programs through consumer subsidies have a crucial role in improving nutrition and diets in regions afflicted with chronic poverty and acute hunger. Secondly, in the context of the National Food Security Act, 2013 under which the PDS is set to expand, the results hold crucial implications.

Though the findings of this paper suggest that greater consumption of grains through PDS leads to an improvements in the consumption of non-grains, a generalisation of the result would need careful consideration. Results arrived here use Odisha as the sample state with KBK districts as our reference point. Since, the KBK districts have been historically found to be nutrient deficient, any form of income of income transfer would promote greater food consumption.

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Appendix

Recommended Dietary Intake (RDA) of nutrients intake as published by the ICMR (2010) is converted into household level RDA which is further arrived at in terms of the consumer unit/adult equivalent level. The ICMR RDA is based upon the gender, nature of job and weight. Unfortunately, the NSS data does not collect any information on individual level nature of work and weight. Hence, we have taken an average of the dietary requirements. The RDA for different category of individuals is as follow:

A 1: ICMR recommended RDA by age and gender

	Age Group	Calorie	Fat	Protein
Man		2320	60	25
Woman		1900	55	20
Infants	<1 year	92	1.16	0
Children	1-3 years	1060	16.7	27
Children	4-6 years	1350	20.1	25
Children	7-9 years	1690	29.5	30
Boys	10-12 years	2190	39.9	35
Girls	10-12 years	2010	40.4	35
Boys	13-15 years	2750	54.3	45
Girls	13-15 years	2330	51.9	40
Boys	16-17 years	3020	61.5	50
Girls	16-17 years	2440	55.5	35

Source: ICMR and NIN

To arrive at the individual level RDA, we divided the household RDA by the adult equivalent according to the following reports from the NSSO Reports:

A 2: Adult equivalent conversion factors

Age (in years)	<1	1-3	4-6	7-9	10-12	13-15	16-19	20-39	40-49	50-59	60-69	>70
Male	0.43	0.54	0.72	0.87	1.03	0.97	1.02	1	0.95	0.9	0.8	0.7
Female	0.43	0.54	0.72	0.87	0.93	0.8	0.75	0.71	0.68	0.64	0.51	0.5

Source: NSSO