# Food Price Subsidies and Nutrition: Evidence from State Reforms to India's Public Distribution System[1]

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*Abstract*: We investigate whether food price subsidies affect household nutrition using a dramatic expansion of the availability of subsidized rice in the Indian state of Chhattisgarh in the early 2000's. Households in Chhattisgarh increased their consumption of pulses, animal-based protein, and produce relative to households in districts bordering the state as the availability of subsidized rice expanded. This increase is driven by households eligible for rice subsidies, and we do not find evidence that ineligible households changed their diet. These results differ from recent studies suggesting that food subsidies have little effect on nutrition.

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JEL classification: D12, I38, O12, O21, O53

## 1. Introduction

Despite widespread improvements in the availability and stability of food supplies, recent estimates suggest there are still between 700 and 870 million malnourished people in the world (FAO 2012a; Fan 2012; Meade and Rosen 2013). Given the difficulties faced by many households in obtaining adequate sustenance, considerable attention has been devoted to measuring different aspects of malnourishment (FAO 2012b), analyzing methods to better deliver food assistance[3], and estimating the effects of food assistance on households.[4]

This article examines the effect of a large, grains subsidy in India on nutrition. Based on recommended dietary allowances in India, households on average have greater deficiencies in non-grains consumption than in grains consumption (National Institute of Nutrition 2010). We focus on non-grains consumption- specifically, consumption of pulses, animal-based protein, and produce - that are associated with higher scores on most diet quality indices and with better health outcomes.[5]

The effect of in-kind food aid on nutrition is theoretically ambiguous. Provided households are inframarginal- the amount of in-kind aid is less than what households actually consume- the effect of in-kind aid should be identical to a cash subsidy. Households will increase their consumption of more nutritious food items if they are normal goods. Alternatively, consumption of these items could remain constant if households instead choose to increase their consumption of non-food goods or food items with less nutritious content, such as processed foods (Behrman and Deolalikar 1989).

A number of studies suggest that food price subsidies have little effect on nutrition in developing countries. Using experimental evidence from China, Jensen and Miller (2011) find little evidence of any nutritional response to subsidizing staple foods. Rather, the authors find some evidence that households substitute toward foods without better nutrition or non-food goods. Tarozzi (2005) examines a decrease in the food grains subsidy in the Indian state of Andhra Pradesh and finds little evidence of an effect on

[3]See Barrett (2002) for a summary.

[4]See Behrman and Deolalikar (1988) and Barrett (2002) for summaries.

[5]See Wirt and Collins (2009) for an overview of studies analyzing the relationship between diet quality and health outcomes and for definitions of 25 separate measures of diet quality used in the literature.

the nutrition of children less than four years of age. [6]

The dietary effects of food price subsidies are particularly important in India. India contains nearly forty percent of the world's food-insecure population (FAO 2012a). This is despite the fact that India spends nearly one percent of its GDP on maintaining its food assistance program, the Public Distribution System (PDS) (Sharma 2012). Based on the current understanding of how price subsidies affect calorie consumption and diet choice, it is uncertain whether these expenditures combat malnourishment and prevent an even higher incidence of food insecurity.

This issue has become even more salient with the recent passage of the National Food Security Act (NFSA), which will dramatically expand the distribution of subsidized food grains in India.[7] The NFSA aims to expand and improve the distribution of food grains through the PDS.[8] Despite this large, projected increase in expenditure on food aid, previous research provides no evidence that expanding the PDS in its current form will improve calorie consumption or diet quality in India (Kaushal and Muchomba 2013, Tarozzi 2005). The NFSA has also been criticized for focusing on grains instead of pulses and other foods that would help diversify a diet that is overly reliant on grains (Sinha 2012).

In order to estimate the nutritional effects of food price subsidies, we examine reforms to the PDS in the Indian state of Chhattisgarh that dramatically expanded the availability of PDS food grains. Previous estimates show the distribution of subsidized food grains is highly inefficient; approximately 54 percent of food grains did not reach their intended beneficiaries in 2004/2005 (Dreze and Khera 2011). Chhattisgarh, however, tried to improve the performance of the PDS following the formation of the state in 2000. Chhattisgarh instituted a number of reforms to the PDS that increased the state's

[6]Other studies of the effects of food price subsidies in developing countries on food consumption include: Gavan and Chandrasekera (1979); Alderman and von Braun (1984); Edirisinghe (1987); Kennedy and Alderman (1987); and Alderman, Chaudhry, and Garcia (1988). These studies compare participants to non-participants and cannot account for selection biases that prevent identification of the effects of such programs on nutrition.

[7]The NFSA was signed into law on September 12, 2013.

[8]The NFSA increases the monthly entitlement of food grain to 5 kg per person for "priority" households and 35 kg per household for the poorest households. The category of "priority" households is to be determined by individual State governments. The NFSA will expand the fraction of eligible households to include up to 75 percent of the rural population and 50 percent of the urban population.

procurement of PDS rice, as well as the number of shops devoted to selling PDS rations. Following the reforms, state procurement of PDS rice and the number of shops selling PDS commodities both approximately doubled between 1999/2000 and 2004/2005.

In contrast to Chhattsgarh, there appear to have been no major PDS reforms during the same time period in states that border Chhattisgarh.[9] We exploit this difference by comparing changes in diet choice in Chhattisgarh to changes in districts that border Chhattisgarh between 1999/2000 and 2004/2005.[10] Just prior to its formation, average household consumption of PDS rice calories in Chhattisgarh was approximately one third that of households in districts neighboring the state. However, following the PDS reforms, the percentage of households consuming PDS rice in Chhattisgarh nearly doubled from 10 percent to 19 percent, and the average amount consumed increased by over 400 percent (Krishnamurthy, Pathania, and Tandon 2014). In contrast, PDS consumption in neighboring districts was unchanged during this period.[11]

We find significant dietary changes in Chhattisgarh relative to border districts as the availability of PDS rice expanded between 1999/2000 and 2004/2005. Households in the state increased their consumption of calories from non-grains sources relative to border districts. Consumption growth in calories from pulses, sources of animal-based protein, and from produce was 13 percentage points higher for households in Chhattisgarh. However, the relative increase in pulse consumption was larger than the relative increase in consumption of other types of non-grains calories. This is consistent with the high rates of poverty in Chhattisgarh, where households were likely turning to the cheaper forms of non-grains calories before substituting towards more expensive calories from produce

[9]The border states are Andhra Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, and Uttar Pradesh.

[10]In an earlier article (Krishnamurthy, Pathania, and Tandon 2014), we presented a series of stylized facts that were intended to inform the policy debate over the PDS in India. Chhattisgarh has been lauded as an example of successful PDS reform, and most observers attribute its perceived success in improving the PDS to initiatives taken by the Raman Singh government after 2004 (Puri 2012). However, we document the fact that PDS rice consumption in Chhattisgarh rose prior to 2004, and that PDS consumption growth in Chhattisgarh after 2004 is comparable to neighboring regions. In this article, we attempt to comprehensively analyze the nutritional effects of reforms undertaken in Chhattisgarh between 1999/2000 and 2004/2005. Our analysis stops before the onset of the global food price spike of 2007, which likely affected PDS consumption and diet choice.

[11]Daily PDS rice calories consumed per household in Chhattisgarh grew from 154 in 1999/2000 to 772 in 2004. In districts bordering Chhattisgarh, daily PDS rice calories consumed was 519 and 512 in 1999/2000 and 2004, respectively (Krishnamurthy, Pathania, and Tandon 2014).

and animal-based protein.

Furthermore, the relative increase in non-grains consumption in Chhattisgarh was accompanied by an increase in protein, calcium, and iron consumption. This finding is consistent with the association between non-grains consumption and better nutritional outcomes (Wirt and Collins 2009). We also find that, because of the large increase in PDS rice consumption, grains consumption grew faster than non-grains consumption. As a result, the share of overall calories composed of grains increased in Chhattisgarh relative to border districts.

We rule out a number alternative channels for our findings. First, it is possible that the advent of statehood improved overall governance for the entire population in Chhattisgarh because the state was formed from outlying regions of a large and relatively poor state (Madhya Pradesh). However, if overall improvements in governance, as opposed to the PDS reforms, were driving the consumption changes, we would not expect to see consumption changes limited only to PDS beneficiaries. To test this hypothesis, we separately estimate the change in consumption of households that were and were not entitled to subsidies. Although data limitations make this estimation difficult, we find that our results are most likely driven by households entitled to the largest PDS subsidies. We do not find any evidence of consumption changes for households that were not entitled to PDS subsidies.

Second, it is possible that the improved performance of the PDS in Chhattisgarh would occur in any small, new state with fewer entrenched interests, and therefore cannot be attributed to Chhattisgarh's PDS reforms. To test this hypothesis, we analyze food consumption changes in two other newly-formed states, Jharkhand and Uttarakhand. Both states were also separated from large and relatively poor states at the same time as Chhattisgarh.[12] However, unlike Chhattisgarh, neither state undertook major PDS reforms during this period. We fail to find evidence of growth in non-grains consumption in Jharkhand and Uttarakhand.

Third, it is possible that improvements in other forms of public support that target

[12]Jharkhand was separated from Bihar and Uttarakhand was separated from Uttar Pradesh.

nutrition could be driving the changes in diet choice in Chhattisgarh. For example, many of the public programs that target nutrition, including the PDS, use below-poverty-line (BPL) status as a factor in eligibility. However, our results do not change when we restrict the sample to households that receive no other forms of public assistance tracked by the consumer expenditure surveys utilized in our analysis.[13]

Fourth, it is possible that national-level changes to the PDS are driving some of the changes that we observe in Chhattisgarh. In 1997, the central government introduced a Targeted PDS scheme that gradually increased the size of the food grain ration and subsidy for BPL households from 1997 to 2001. States with a better-functioning PDS may have had an advantage in targeting poor households and ensuring access to rations (Kaushal and Muchomba 2013). However, we find no evidence that our results for Chhattisgarh are common to states that have been associated with a better-functioning PDS. In particular, our results do not change when we compare consumption changes in Chhattisgarh only to border districts from states where the PDS functions well.[14] We also rule out the possibility that our findings are a result of official changes in BPL card eligibility. Because of litigation in the Supreme Court, all BPL changes were frozen in rural areas during the time period under analysis, and all findings are identical when the sample is restricted to only rural households.

Fifth, it is possible that our findings are a result of different underlying trends in non-grains consumption in Chhattisgarh and border districts that preceded Chhattisgarh's PDS reforms. However, we provide evidence that trends in non-grains consumption were similar across districts that would later form Chhattisgarh and border districts prior to the formation of the state. Our findings are also robust to alternate control areas. We find nearly identical estimates whether we use all border districts, Madhya Pradesh (from which Chhattisgarh was carved out), or the rest of India as control areas.

[13] Although not all of these programs use BPL status as a factor in eligibility, we exclude households that receive benefits from Food For Work, Annapurna, Integrated Child Development Services (ICDS), and the Midday Meal Schemes, each of which supply households with food items and might alter household diet choice.

[14] As in Kaushal and Muchomba (2013), we utilize Khera (2011a) to identify states where the PDS functioned well. Of the states that border Chhattisgarh, both Andhra Pradesh and Maharashtra were designated as states where the PDS functioned well.

This article adds to the literature analyzing the effects of food price subsidies on diet quality and consumption. In particular, our results are releated to Jensen and Miller (2011), who find no evidence of a nutritional response to food price subsidies using experimental evidence in China. This difference in findings could be a result of the nature of the subsidy. Jensen and Miller (2011) consider price subsidies for staple grains in an amount that exceeds what households would normally consume (i.e., households are not inframarginal). In contrast, the PDS rations that we consider are less than what households would normally consume. This difference could also stem from differences in the level of development of the treated populations. Households in Chhattisgarh that are entitled to the largest PDS subsidies are potentially less well off than the poor Chinese households analyzed by Jensen and Miller (2011).

Our results also differ from studies that find no evidence for an effect of PDS consumption on non-grains consumption and malnutrition in India (Kochar 2005; Tarozzi 2005; Kaushal and Muchomba 2013). Kaushal and Muchomba (2013) find no effect of changes to the PDS in 2002 on nutrition in poorer and rural households. They do find evidence that households that were more likely to be eligible for PDS subsidies increased their consumption of PDS rice and wheat and lowered their consumption of coarse grains relative to households that were less likely to be eligible for subsidies. The authors restrict their sample to households with expenditure below the median, but it is still difficult to argue that the likelihood of being eligible for PDS subsidies is not correlated with household wealth or other determinants of PDS and coarse-grains consumption. As a result, it is difficult to attribute these changes consumption solely to the changes in the PDS.

Tarozzi (2005) finds no evidence that a decrease in PDS subsidies affects the weight of children under four. The differences between the results presented here and Tarozzi (2005) could be the result of a number of factors. First, we document a larger change in the availability of PDS food grains. Second, we are able to directly observe PDS participation and diet choice at the household level. Third, measurement error might be less of a concern in our setting because we use the entire household as the unit of analysis, as opposed to a subset of the household. We also focus on diet choice rather than weight,

for which there are other significant determining factors (Lewit and Kerrebrock 1997). Lastly, Tarozzi (2005) utilizes evidence from a state - Andhra Pradesh - in which the PDS functioned well, whereas we examine PDS expansion in a less-developed state where the PDS initially functioned poorly.[15]

Our findings are also related to studies analyzing how diet choice responds to negative income shocks. A number of studies find that households in developing countries respond to such shocks by increasing consumption of cheap grains and reducing consumption of more expensive calories derived from better sources of protein and nutrients (e.g., Block et al. 2004; Brinkman et al. 2009). These studies, combined with studies finding no nutritional response to in-kind assistance (Kochar 2005; Tarozzi 2005), suggest that either households have asymmetric responses to negative and positive income shocks, or that households are not in fact inframarginal (i.e., in-kind assistance is not identical to a cash subsidy). However, the evidence we present from Chhattisgarh is consistent with households having a symmetric response to negative income shocks and an expansion of in-kind food assistance.

Finally, this article is related to the literature analyzing the effects of in-kind food assistance on diet choice in developed countries. Utilizing natural experiments in the U.S., a number of studies find that in-kind food aid leads to higher expenditure on food consumed at home (Hoynes and Shazenbach 2009; Beatty and Tuttle 2012). However, these studies are unable to identify the nutritional content of this increased spending, which is the primary focus of our analysis.[16]

The rest of the article is structured as follows. Section 2 describes the PDS; Section 3 describes the PDS reforms in the state of Chhattisgarh; Section 4 describes the data; Section 5 describes the estimation strategy and presents the results; Section 6 presents estimates from a number of robustness checks; and Section 7 concludes.

[15]These results also add to the literature describing the ability of the PDS to reach the poor and the implicit subsidies provided by the PDS. For examples, see Dev and Suryanarayana (1991), Howes and Jha (1992), Ahluwalia (1993), Parikh (1994), Indrakanth (1997, Radhakrishna et al. (1997), Mooij (1999), Dutta and Ramaswami (2001).

[16]There are also a number of studies that try to estimate the marginal impact of food stamp benefits on nutrient or food availability in the U.S. (Ranney and Kushman 1987; Fraker 1990; Devaney and Moffitt 1991; Levedahl 1991; Fraker, Martini, and Ohls 1995). However, these studies do not rely on natural experiments and cannot account for selection issues that make such elasticities difficult to interpret.

## 2. The Public Distribution System

The PDS distributes a number of essential commodities to households across India. These commodities primarily consist of food grains, kerosene, and sugar.[17] Prior to 1997, the program was available to almost all households, at least in principle, and was intended to stabilize food prices and provide food security (Radhakrishna et al. 1997). Following 1997, the PDS was transformed into the Targeted Public Distribution System, which emphasized targeted food subsidies for the poorest households (Ministry of Consumer Affairs 2002).

The PDS is run by both central and state governments. The central government procures rice and wheat through the Food Corporation of India (FCI), which pays a government-mandated Minimum Support Price (MSP) to farmers. The central government then allocates food grains at a much lower rate to individual states based on the number of below-poverty-line (BPL) households, which is determined by the official poverty line set by the Planning Commission (Ministry of Consumer Affairs 2002).[18] States can also secure food grains for above-poverty-line (APL) households, but at a much higher rate.

State governments are responsible for identifying the PDS entitlements of individual households and distributing PDS commodities through a network of Fair Price Shops (FPSs). State governments distribute ration cards to individual households, which entitle them to different quantities and rates of PDS food grains. In this article, we refer to all ration cards that receive the most preferential rates as "BPL" ration cards, and to all other ration cards as "other" ration cards.[19] Households that do not have ration cards

[17]Different states can offer different commodities in addition to rice, wheat, kerosene, and sugar. For example, Chhattisgarh offers rations of iodized salt and, following 2012, also offers a ration of pulses (Food Security Act (Chhattisgarh), 2012).

[18]BPL status is determined by a survey of household assets and expenditure, and the criteria are different depending on whether the household resides in an urban or rural area (Ministry of Consumer Affairs 2002). The initial estimates of BPL households for each state were determined from the Planning Commission's state-wise poverty estimates for 1993-1994 and the population projections of the Registrar General of India for 1995. These population projections were then updated in 2000 based on the Registrar General's 2000 projections.

[19]Throughout, the types of ration cards receiving the largest subsidies are Antyodaya (AAY) and BPL cards. Under the Targeted PDS, BPL households were eligible to receive 10kg of food grains at subsidized prices. This ration was increased to 20kg in 2000, 25 kg in 2001, and 35 kg in 2002. AAY households are the poorest among BPL households, but represent only 3 percent of sampled households in both

are not entitled to purchase PDS food grains.

There are large differences in the PDS consumption patterns of households with BPL ration cards and households with other types of ration cards. BPL households generally consume high levels of PDS food grains, whereas non-BPL households have much lower PDS consumption. Most non-BPL households do not consume any PDS food grains (e.g, Majumder 2001).[20] These differences are likely driven by the significantly higher prices for PDS grains faced by households without BPL ration cards. PDS grain prices for these households can sometimes rise above the local market prices (Majumder 2001). Because PDS food grains are generally viewed as inferior goods (Rao 2000; Majumder 2001), households without a BPL ration card only turn to PDS grains during times of economic distress when market prices increase. Consistent with this explanation, PDS consumption rose across the entire country following the global food price crisis and the global financial crisis (Krishnamurthy, Pathania, and Tandon 2014).

The delivery of PDS food grains to households is inefficient in many states. Estimates of diversion - the difference in the amount of PDS rations procured by states and the amount households report they consume - are alarmingly high (Ministry of Consumer Affairs 2002; Planning Commission 2005; Jha and Ramaswami 2011). It is estimated that 54 percent of food grains were diverted to the open market in 2004/2005 (Dreze and Khera 2011). Recent research suggests that some states have seen an improvement in PDS performance. Using a small number of districts, Khera (2011b) estimates that sampled households receive over ninety percent of their PDS ration on average, and that they do not receive low quality grains. Khera (2011a) also finds that there are only a handful of states in which the PDS continues to operate poorly and households purchase less than eighty percent of their ration on average. Although it is difficult to identify

Chhattisgarh and border districts. The baseline results are identical when restricting the analysis to only BPL households, and similar but slightly less precisely estimated when restricting the analysis to only AAY households.

[20]The online Appendix demonstrates that PDS take-up among BPL households in Chhattisgarh and in border districts is high. In 2004-2005, approximately 52 percent of these households in Chhattisgarh and 72 percent of these households in border districts consumed some PDS rice. In contrast, very few non-BPL households consume any PDS rice. In Chhattisgarh, approximately 4 percent of households with other ration cards and 3 percent of households with no ration card consumed some PDS rice in 2004-2005. These figures are 5 percent and 2 percent, respectively, for border districts in this period.

exactly how states turned around their distribution of PDS food grains, Khera (2011a) suggests that the improvement is in part due to PDS reforms in these states.

The PDS has been widely criticized. The Ministry of Consumer Affairs published a report criticizing the PDS along a number of dimensions: the types of commodities it provides, problems with targeting poor households, and the inability of a large number of poor and food-insecure households to obtain BPL rates (Ministry of Consumer Affairs 2002). In light of these concerns, many commentators have called for the government to fundamentally redesign its food assistance program (Basu 2011). Other recommendations focus on improving the current system by removing APL subsidies for grains altogether and increasing the number of households entitled to BPL rates to avoid exclusion errors in targeting subsidies (Ministry of Consumer Affairs 2002).

The public debate over the PDS has taken on greater urgency with the passage of the National Food Security Act (NFSA) in September 2013. The NFSA makes subsidized food grains a legal right, as opposed to a discretionary piece of the social safety net. The NFSA dramatically increases the share of households entitled to subsidized grains to almost two-thirds of the country's population of 1.2 billion. The NFSA also recommends a series of other reforms to improve the present system. These reforms include preferences for public bodies and women's collectives in administering FPSs, doorstep delivery of food grains, public availability and computerization of records, periodic social audits, and vigilance committees from the state to the FPS-level to supervise each step of the distribution process.

## 3. PDS Reforms in Chhattisgarh between 2000 and 2004

Chhattisgarh instituted a number of reforms to improve the functioning of its PDS. Table 1 presents a timeline of these reforms. Most importantly for our analysis, two of these reforms took place before 2004. First, Chhattisgarh allowed private dealers to run FPSs, which improved access to FPSs across the state. Second, Chhattisgarh increased the amount of rice that it procured directly from in-state farmers to be distributed through the PDS.

Lack of access to FPSs is especially important in a predominantly rural state like Chhattisgarh. In 2000 the number of FPSs per thousand people in Chhattisgarh was less than half the number in border states (Figure 1). At this time, all the FPSs in Chhattisgarh were operated by co-operatives but, according to the state government, they were not in a financial position to extend their coverage (Patnaik 2005). The government of India also voiced concerns over FPS coverage in rural areas, and suggested that reforms to the operation of FPSs where coverage was limited could improve access to food aid (Ministry of Consumer Affairs 2002).

In 2001, Chhattisgarh began to grant licenses to own and operate FPSs to private parties under the Sarvajanik Nagrik Poorti Vitran (SNPV) scheme. As a result of this reform, the number of FPSs in the state doubled between 2001 and 2004 (Figure 1). By 2004, nearly 60 percent of FPSs were privately owned and operated.[21]

In addition to privatizing the ownership of FPSs, Chhattisgarh also restructured its system of procurement for PDS rice. In 2002, Chhattisgarh began to participate in the decentralized procurement scheme (DCP). Under the DCP, state governments procure rice and wheat directly from local farmers at the minimum support price (MSP) and are reimbursed by the central government. From 2002 to 2004, PDS rice procurement by Chhattisgarh rose from just under one million metric tons to just under two million metric tons, an increase of almost 100 percent (Figure 1).[22] Consistent with these reforms having an effect, per capita consumption of PDS rice tripled over this period (Figure 1).[23]

States with districts that share a border with Chhattisgarh did not, to the best of our knowledge, undertake comparably comprehensive PDS reforms between 1999 and 2004. A search of news stories in the *Times of India* and the *Hindu* from 1998 to 2005 reveal no evidence of large-scale PDS reforms in neighboring states, and studies of PDS diversion

[21]There were 8637 total FPSs in 2004, of which 5049 were privately owned.

[22]Despite the increase in procurement by the state government during this time period, the online Appendix demonstrates that there were no observable income changes in Chhattisgarh relative to border districts for cereals producers or for the general population.

[23]There were a number of reforms announced in December of 2004 through the PDS (Control) Order 2004. This Order discontinued the operation of private FPSs and instituted reforms to the oversight and delivery of grains to FPSs. However, these reforms fall outside the period of study in this article. The PDS (Control) Order was not implemented until the resolution of a Supreme Court case in September of 2005 (Patnaik 2005). The final survey utilized for the baseline analysis in this article was completed by June of 2005.

across states over this time period do not mention reforms in these states (Khera 2011a, 2011b).[24,25]

Consistent with this lack of reform, there was little change in FPS coverage, PDS rice procured directly by governments, and average PDS rice consumption in states that border Chhattisgarh (Figure 1).[26] We also do not find evidence for different trends in PDS rice consumption in Chhattisgarh and bordering states prior to the reform period.[27]

## 4. Data

In order to estimate the response of diet choice to PDS consumption, we utilize consumption data obtained from consumer expenditure surveys conducted by the National Sample Survey Organization (NSSO) in India. Each survey is a repeated cross-section and covers the entire country. The survey is stratified by whether a household resides in a rural or urban area, and is further stratified by relative household affluence. In the baseline estimates, we utilize the "thick" rounds conducted in 1999/2000 (55'th Round) and 2004/2005 (61'st Round).[28]

Each survey provides data on quantities and values of food items consumed over the past thirty days and separately reports the amount of PDS rice, wheat, sugar, and kerosene consumed by each household. Each survey also reports a number of household characteristics and the district in which each household resides. From this data, we are able to estimate household calorie consumption from each source by utilizing nutritional

[24]Specifically, we searched the two newspapers using Factiva. We searched for the words "Public," "Distribution," "System," and the name of the state in each individual search.

[25]After 2005, a number of states bordering Chhattisgarh - Andhra Pradesh, Madhya Pradesh, and Odisha - implemented PDS reforms. We therefore restrict our analysis to the effect of reforms in Chhattisgarh between 1999/2000 and 2004/2005.

[26]This figure is reproduced from Krishnamurthy, Pathania, and Tandon (2014).

[27]In the online Appendix, we demonstrate that growth in PDS rice consumption in Madhya Pradesh and districts that would later form Chhattisgarh was not different from states bordering the future state of Chhattisgarh between 1993/1994 and 1999/2000. Unfortunately, data limitations make it impossible to demonstrate that PDS rice consumption did not change prior to the reform period in Chhattisgarh and border districts. The only other NSSO survey conducted prior to 1999/2000 that reports PDS consumption is the 50'th round conducted in 1993/1994. This survey does not have district identifiers, so we cannot identify districts of Madhya Pradesh that would later become Chhattisgarh or districts that would border the future state.

[28]The rounds are referred to as "thick" due to the higher number of households surveyed compared to the annual "thin" surveys.

information provided by Gopalan, Rama Sastri, and Balasubramanian (1991). All food items consumed at home are combined into the following groups: grains, pulses, sources of animal-based protein (dairy and meat), and produce (fruits and vegetables).

There are some differences between the two surveys used in the baseline analysis. Although both surveys provide information on the amount of PDS commodities consumed, only the survey conducted in 2004/2005 contains information on whether households have a ration card entitling them to purchase PDS food grains.[29] This difference matters most in specifications in which changes in diet choice are estimated separately for households with different types of ration cards.

We use these surveys to compare non-grains consumption in Chhattisgarh, or districts in Madhya Pradesh that would later become Chhattisgarh, to non-grains consumption in districts that border the state. District boundaries change over time, so we utilize the boundaries in effect in 1999, the time the baseline survey (55'th Round) used in the empirical analysis was conducted.[30] The border districts come from a number of states: Andhra Pradesh (3), Jharkhand (3), Maharashtra (2), Madhya Pradesh (6), Odisha (8), and Uttar Pradesh (1).[31] Figure 2 presents a map of Chhattisgarh and districts that border the state.[32]

Table 2 presents summary statistics separated by survey, and illustrates a number of important consumption patterns. First, average at-home food consumption in Chhattisgarh and districts that border the state is predominately composed of grains (specifically rice) consumption, and average calorie consumption from pulses, produce, and animal-based protein is significantly lower than estimates for other parts of India (National

[29]The survey conducted in 1999/2000 did ask whether the lack of a ration card was the reason no PDS purchase was made in the prior 30 days. Unfortunately, the NSSO did not include this information on the publicly available data file.

[30]In addition, some districts were carved out of two or more existing districts. In such instances, the two or more existing districts are aggregated to a larger region to keep borders consistent across all surveys.

[31]The districts that border Chhattisgarh are listed as follows. From Andhra Pradesh- Karimnagar, Khammam, Warangal; from Jharkhand- Garhwa, Gumla, Simdega; from Maharashtra- Bhandara, Chandrapur; from Madhya Pradesh- Anuppur, Balaghat, Dindori, Shahdol, Sidhi, Singrauli; from Odisha- Bargarh, Jharsuguda, Kalahandi, Koraput, Malkangiri, Nabarangpur, Naupada, Sundargarh; and from Uttar Pradesh- Sonbhadra.

[32]The online Appendix provides the total number of households listed by state that are utilized in the baseline analysis.

Sample Survey Organization 2007). Second, in the 2004/2005 survey, slightly less than one-third of households have a BPL card entitling them to the largest PDS subsidies, and approximately 38 percent of households have no ration card and therefore are not entitled to purchase PDS food grains. Therefore, each type of household is well represented in the sample, which allows us to separate consumption by type of ration card in the 2004/2005 survey. Third, average at-home food consumption decreases over this time period and the number of meals consumed out of the household increases. As a result, the composition of the household diet is increasingly unobservable. This is consistent with other estimates of food consumption in India (National Sample Survey Organization 2007; Deaton and Dreze 2009).[33]

In addition to the "thick" rounds conducted in 1999/2000 (55'th Round) and 2004/2005 (61'st Round), this study also utilizes the "thin" rounds conducted in 1997 (53'rd Round) and 1998 (54'th Round) to estimate trends in consumption prior to the formation of Chhattisgarh.[34] Unfortunately we cannot use the "thick" round conducted in 1993/1994 (50'th Round) to estimate pre-existing trends in consumption because there are no district identifiers available in this survey. As a result, we cannot identify households residing in districts that would later form Chhattisgarh, or households residing in districts that would border the future state.[35]

[33]Table 2 also reports a slight increase in the share of the sample that is rural. This change is likely driven by the re-weighting of the rural/urban sample that took place in the 2001 Census. There is also an increase in the share of the sample that is self-employed. The re-weighting of the sample also likely contributes to this change because the NSSO definition in rural areas is households that are self-employed in non-agricultural sectors. Lastly, there is a drop in the consumption of other PDS commodities between the 55'th and the 61'st round. This difference is driven by a change in the eligibility for PDS sugar that affected the entire country.

[34]The sampling procedure is different between the "thin" and "thick" rounds. For both "thin" and "thick" rounds the stratification is based on sector (rural versus urban) and relative affluence, but the relative size of the rural/urban sample in the two types of rounds differ. However, all results comparing the two types of surveys are identical when conditioning on sector and affluence, and are similar if we restrict the analysis to particular second-stage strata within which there is random sampling of households. Furthermore, the "thin" rounds also report fewer household characteristics than the "thick" rounds, which limits household-level control variables in specifications using both types of rounds to those that are available in all surveys.

[35]However, there are no differential trends in non-grains consumption between districts that would later form Chhattisgarh and border districts between the 1987/1988 survey (43'rd Round)- the "thick" round preceding the 1993/1994 survey- and the baseline, 1999/2000 survey (55'th Round) used in the analysis.

## 5. Estimation Strategy and Baseline Results

Ideally, we would like to randomize participation in the PDS and compare the non-grains consumption of households assigned to the treatment group to the non-grains consumption of households assigned to the control group. Such a design would limit the confounding factors present when simply comparing participants to non-participants without randomization. Households self-select into participation based on both observable and unobservable characteristics. This makes the participant/non-participant comparison difficult to interpret.

For example, households that do not participate in the PDS tend to have higher non-grains consumption than those that receive the largest PDS subsidies. This fact does not imply that PDS subsidies lead to worse household nutrition. It is more likely that this difference in non-grains consumption is driven by the higher wealth of non-participants. Comparing PDS participants to non-participants with similar wealth levels does not eliminate this selection problem. Households obtaining ration cards may be more informed about their entitlements or have better local political connections, each of which might cause their diet choice to be different from non-PDS participants in the absence of participation.

Our identification strategy is to compare changes in the non-grains consumption of households in Chhattisgarh to those of households in districts bordering the state that did not experience reforms.[36] We utilize households in border districts to construct the counterfactual of consumption changes in Chhattisgarh in the absence of PDS reforms. Households in border districts are more likely to be similar to households in Chhattisgarh

[36]It is also possible to analyze specifications utilizing anthropometric and health outcomes of women and children obtained from the Demographic and Health Surveys (DHS) conducted in 1998/1999 and 2005/2006 as dependent variables. This would allow us to estimate the effect of the PDS reforms in Chhattisgarh on broader health outcomes. However, due to HIV testing conducted in the latter survey, district identifiers have not been released to researchers to protect the anonymity of households. Thus, the analysis would have to be restricted to comparing Chhattisgarh to border states, which include the country's two most populous states and nearly half of India's total population. Unfortunately, these specifications are less than ideal. First, it is unlikely that all households in border states serve as good counterfactuals to households in Chhattisgarh. Second, measurement error is likely to be more of a concern for the DHS specification relative to the baseline specification. The baseline specification analyzes the entire household, as opposed to a subset of the household (women and children); and the baseline specification analyzes household diet, as opposed to measuring symptoms of malnutrition, for which there are other significant determining factors (Lewit and Kerrebrock 1997).

in terms of their unobserved characteristics than are households from the rest of India. Table 3 presents summary statistics for non-grains consumption and household characteristics for households in Chhattisgarh and those in border districts prior to the PDS reforms. Consistent with our assumption, column (3) shows that there are few observable differences between households in Chhattisgarh and border districts.[37]

Table 4 presents the empirical strategy in a difference-in-differences table separated by calorie source. Column (1) demonstrates that there was a dramatic increase in PDS rice consumption in Chhattisgarh between 1999/2000 and 2004/2005 relative to border districts, where PDS rice consumption hardly changed.[38] The difference-in-differences is 111 daily PDS rice calories per capita. This finding suggests that the reforms to FPSs and state procurement of rice had a substantial impact on the availability of PDS food grains in Chhattisgarh. Columns (2) through (4) show that calories from pulses, produce, and sources of animal-based protein all increased in Chhattisgarh relative to households in border districts, although the estimates for calories from produce and animal-based protein are imprecise. Lastly, column (5) demonstrates that there was no significant difference in non-PDS rice consumption between Chhattisgarh and districts that border the state.

We implement this identification strategy by estimating the following baseline specification:

$$ln(NonGrains\_Calories_{idt}) = \kappa_d + \gamma CT_{idt} * Post_{idt} + \beta X_{idt} + \epsilon_{idt} \quad (1)$$

where $d$ denotes districts according to 1999 boundaries; $t$ denotes the time period ($t$=1999, 2004); $\kappa_d$ denotes district fixed effects; $NonGrains\_Calories$ denotes daily per capita calories consumed from pulses, sources of animal-based protein, and produce; $CT$ denotes an indicator equal to one if the household resides in Chhattisgarh; $Post$ denotes an

[37]There is a notable exception to these pre-reform similarities in household characteristics. Krishnamurthy, Pathania, and Tandon (2014) demonstrate that average PDS rice consumption is significantly lower in Chhattisgarh than in districts that border the state. These differences disappear by 2004/2005, the end of the first wave of PDS reforms in Chhattisgarh.

[38]This column reproduces a finding from Krishnamurthy, Pathania, and Tandon (2014).

indicator equal to one if the household observation is taken from the 2004/2005 survey; and $X$ contains *Post* and time-varying control variables.[39]

The coefficient of interest is $\gamma$, which gives the difference-in-differences estimate of the effect of PDS reforms on non-grains calorie consumption. If the increased availability of PDS rice led to higher consumption from more diverse calorie sources in Chhattisgarh relative to border districts, then estimates of $\gamma$ should be positive and significant. The baseline specification estimates robust standard errors clustered at the district level. To account for the possibility of state-level correlation in the error term, we also include p-values based on standard errors clustered at the state level. Given the small number of border states, we estimate the standard errors clustered at the state level using the wild cluster-bootstrap percentile-t method described in Cameron, Gelbach, and Miller (2008).[40]

Households in Chhattisgarh increased their non-grains consumption relative to border districts between 1999/2000 and 2004/2005. Table 5 reports these findings from the baseline specification. Column (1) estimates the simplest difference-in-differences specification; column (2) adds district fixed effects; and column (3) adds household-level control variables. The estimates are positive and similar in magnitude, and the precision increases with each refinement. In the most complete specification in column (3), households in Chhattisgarh increased their consumption of calories from pulses, produce, and sources of animal-based protein by 13 percentage points more than households in border districts.

[39]Controls include the natural logarithm of the number of meals consumed outside the household, the natural logarithm of non-food expenditure, indicators for whether a household resides in a rural area, indicators for whether a household is self-employed, indicators for whether a household has consumed any PDS commodity aside from food grains (i.e., kerosene and sugar) over the past thirty days, indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist), and indicators for whether a household belongs to a Scheduled Caste or a Scheduled Tribe.

[40]We investigated matching methods to estimate the effects of the PDS reforms in Chhattisgarh on diet choice. We first investigated the difference-in-differences matching estimator proposed by Smith and Todd (2005) and Blundell and Costa-Dias (2000). This estimator is the difference between the matching estimator in Chhattisgarh and the matching estimator in border districts, which each use a post indicator to define treatment. The standard error is calculated with the bootstrap. However, Abadie and Imbens (2008) demonstrate that standard errors calculated with the bootstrap fail to perform well in even the most simple matching estimator, which suggests such an estimator might be inappropriate. We instead use the matching estimator proposed by Abadie et al. (2004) to estimate treatment separately in Chhattisgarh and border districts, using the post indicator to define treatment and matching on the household-level control variables in the baseline specification. We find that the difference is nearly identical to the OLS estimates discussed in Section 5. Moreover, the estimated 95 percent confidence intervals of the two estimates do not overlap. See the online Appendix.

The results are qualitatively identical when clustering the standard errors at the state level.

Chhattisgarh had higher growth in each individual calorie source. Columns (4) - (6) of Table 5 reports these findings separately by individual caloric source. The estimate for calories from pulses in column (4) is more precisely estimated and has a larger magnitude than the estimates for calories from produce or animal-based protein in columns (5) and (6). These results suggest that households primarily diversified their diets toward pulses, which is a cheaper source of calories than other types of non-grains consumption. This finding is consistent with the poor economic status of households in Chhattisgarh, which are poorer than households from the rest of India on average (National Sample Survey Organization 2007).

In contrast to non-grains consumption, column (7) demonstrates that there was little change in non-PDS rice consumption as the availability of PDS food grains greatly expanded. Given the lack of change in non-PDS rice consumption, column (8) demonstrates that the share of grains in the overall diet increased by 1.7 percentage points more in Chhattisgarh than in border districts.

Table 6 more fully examines the nutritional implications of higher non-grains consumption. The quality of calories consumed in Chhattisgarh improved relative to border districts (columns (2)-(6)), even though there was no difference in total calorie consumption between the two regions. In particular, total consumption of protein, iron, and calcium significantly increased in Chhattisgarh. This is consistent with evidence that higher non-grains consumption is associated with better nutritional outcomes (Wirt and Collins 2009).

### A. Consumption Changes by Type of Subsidy

We separately estimate the growth of non-grains consumption in Chhattisgarh, relative to border districts, for households holding different ration cards. We provide evidence that households entitled to PDS food grains were responsible for this growth in Chhattisgarh. Moreover, we do not find evidence of an increase in non-grains consumption for

households with no entitlement to PDS food grains. These results help to rule out the hypothesis that non-grains consumption growth in Chhattisgarh was a result of unobserved factors that were unrelated to changes in the PDS.

Unfortunately, data limitations do not allow us to directly estimate changes in consumption for households with particular types of ration cards. Only the post-survey (2004/2005) includes the type of ration card held by each household. Despite this limitation, we implement several empirical strategies to separately estimate changes in non-grains consumption for households with and without ration cards.

First, we proxy for ration card ownership in the pre-survey (1999-2000) using an indicator for whether a household reports any PDS rice consumption. Column (1) of Table 7, presents an estimate of the baseline specification restricting the sample to actual ration card holders in the post-survey (2004/2005) and households that consumed any PDS rice in the pre-survey. The growth of non-grains consumption for these households in Chhattisgarh relative to border districts (22.5 percentage points) is greater than each of the baseline estimates in Table 5. This finding suggests that households with ration cards are driving the growth in Chhattisgarh.

In contrast, column (2) of Table 7 presents an estimate of the baseline specification restricting the sample to households without a ration card in the post-survey and households that did not consume any PDS rice in the pre-survey. The growth of non-grains consumption for these households in Chhattisgarh relative to border districts (7.4 percentage points) is smaller than the baseline estimates in Table 5 and is not statistically significant.

Although suggestive, these tests are imperfect. First, PDS consumption is an endogenous decision that could reflect a negative income shock and abnormal market prices for rice. PDS consumption increases for households with other ration cards during times of economic distress when the market price of rice increases (Rao 2000; Majumder 2001; Krishnamurthy, Pathania, and Tandon 2014). Given that households undergoing economic distress also reduce non-grains consumption (Block et al. 2004; Brinkman at al. 2009), the comparison of non-grains consumption based on PDS consumption is less than ideal.

Second, households in Chhattisgarh that were entitled to PDS food grains in the pre-survey may not have consumed any PDS rice due to the poor functioning of the program. Our proxy variable mistakenly assumes that these households do not hold ration cards. Because households with ration cards have lower non-grains consumption, our estimate of non-grains consumption growth for households without a ration card (column 2 of Table 7) will be biased upward. Despite this potential upward bias, the estimate suggests that households without ration cards are not responsible for the relative growth of non-grains consumption in Chhattisgarh.

In addition to proxying for ration card ownership in the pre-period, we also compare non-grains consumption by type of ration card in the post-survey to average consumption in the pre-survey. We estimate the baseline specification while restricting post-observations to households with BPL ration cards, other ration cards, and no ration cards, respectively. For these specifications, $\gamma$ measures the difference between the average non-grains consumption for ration card holders in the post-survey and the average for all households in the pre-survey in Chhattisgarh relative to border districts.

Columns (3), (5), and (7) of Table 7 report the results by type of ration card. These results suggest that the change in non-grains consumption in Chhattisgarh is driven by households with BPL ration cards that entitle them to the highest PDS subsidies. In column (3) of Table 7, we restrict the households in the post-survey to those with BPL cards. This estimate is similar in magnitude to the baseline estimates in Table 5, but is more precise. In columns (5) and (7) of Table 7 we restrict households in the post-survey to those with other ration cards and no ration cards, respectively. The magnitude of each estimate is smaller than the baseline estimates in Table 5, and we cannot reject the hypothesis that there was no difference between Chhattisgarh and border districts in the growth of non-grains consumption.

Restricting the sample in the post-period by type of ration card requires additional assumptions to produce unbiased difference-in-differences estimates in columns (3), (5), and (7) in Table 7. To see why, suppose that there is no increase in the non-grains consumption of households with BPL ration cards in Chhattisgarh in the post-survey.

Restricting the post-sample to BPL card holders, as in column (3) of Table 7, could result in a spurious increase. If, during the pre-survey the non-grains consumption of households with no ration cards in border districts is higher than in Chhattisgarh, then the average across all households in border districts will also be higher. This will depress the difference in the border districts between 1999/2000 and 2004/2005, relative to the difference in Chhattisgarh, and artificially increase the difference-in-differences estimate. Alternatively, if during the pre-survey the share of households with a BPL ration card in border districts is lower than in Chhattisgarh, then the average non-grains consumption across all households in border districts will again be higher. This will create a smaller difference in border districts between 1999/2000 and 2004/2005 relative to the difference in Chhattisgarh, and again artificially increase the difference-in-differences estimate.

In the online Appendix, we formally derive this bias and show that sufficient conditions for an unbiased estimate are that in the pre-survey: (1) the share of households with BPL cards in Chhattisgarh is equal to the share in border districts, and (2) the average difference in non-grains consumption between households with BPL ration cards and households without ration cards in Chhattisgarh is equal to the difference in border districts. Although these are stringent conditions, we utilize border districts precisely because they are similar to Chhattisgarh. Moreover, we cannot reject the hypotheses that: (1) the share of households with BPL cards in Chhattisgarh is equal to the share in border districts in the post-survey, and (2) the average difference in non-grains consumption between households with proxied ration cards and households without proxied ration cards in Chhattisgarh is equal to the difference in border districts in the pre-survey.[41] This suggests that the potential bias in the difference-in-differences estimates by type of subsidy in columns (3), (5), and (7) of Table 7 is unlikely to be large.

We perform a number of additional robustness checks in light of these concerns. We exclude border districts in Andhra Pradesh and Maharashtra because they differ the most from Chhattisgarh in terms of household expenditure in the pre-survey; and we exclude border districts in Orissa and Uttar Pradesh because they differ the most in

[41] See the online Appendix.

terms of non-grains consumption in the pre-survey. Columns (4), (6), and (8) of Table 7 report estimates where we exclude these border districts and restrict households in the post-survey to ones with BPL ration cards, other ration cards, and no ration cards, respectively.[42] These results continue to suggest that households with ration cards that entitle them to the highest PDS subsidies are driving the change in non-grains consumption in Chhattisgarh. This conclusion does not change if we drop border districts from any individual state or if we compare non-grains consumption in Chhattisgarh to border districts from each state individually. Within the latter set of comparisons, some of the control groups have nearly identical consumption of non-grains calories to Chhattisgarh in the pre-period.[43]

Finally, it is unlikely that differential changes in the ownership of BPL ration cards in Chhattisgarh and border districts are confounding our results. BPL status was fixed in rural areas during the time period under analysis, and approximately 70 percent of households in Chhattisgarh and border districts are rural.[44] The results in Table 7 estimating consumption changes by type of ration card are identical when the sample is restricted to rural households.[45]

## 7. Robustness Checks of the Baseline Specification

We perform a number of additional robustness checks for our baseline specification. First, we provide evidence that our results are not an artifact of the comparison region. Column (1) of Table 8 compares non-grains consumption growth in Chhattisgarh to all of Madhya Pradesh[46]; column (2) compares growth in Chhattisgarh to all of India. The results in columns (1) and (2) are similar to the differences between Chhattisgarh and border districts in Table 5.

[42]Specifications comparing non-grains consumption in Chhattisgarh to consumption in the border districts from the excluded states are also identical to the baseline results.

[43]These results are available on request.

[44]There was a BPL survey conducted in 2002, but the rural survey could not be finalized due to a stay issued by the Supreme Court of India. The stay remained in effect until 2006.

[45]The results are similar for urban households, but the estimates are less precise due to a smaller sample size.

[46]Chhattigarh was formed from Madhya Pradesh in November 2000.

Second, we provide evidence that our findings for Chhattisgarh in this period are not common to states with a better-performing PDS. The central government introduced the Targeted PDS program in 1997 and gradually increased the food grain allotment from 10kg to 35 kg per household from 1997 to 2001. Under this program, individual states were responsible for identifying BPL eligible households, distributing ration cards, and ensuring the delivery of PDS food grains. The 2001 PDS (Control) Order also directed the states to develop effective procedures to accomplish these ends. Therefore, states with better-functioning PDSs may have had an advantage in targeting poor households and ensuring their access to rations (Kaushal and Muchomba 2013).

However, we find no evidence that our results for Chhattisgarh are common to states that have been associated with a better-functioning PDS (Khera 2011a, Kaushal and Muchomba 2013). Khera (2011a) classifies Andhra Pradesh and Maharashtra as "functioning." However, column (3) of Table 8 demonstrates that non-grains consumption in Chhattisgarh grew more than in border districts in Andhra Pradesh and Maharashtra.

Third, we provide evidence that our results are not driven by improvements to other forms of public assistance. A number of other types of public assistance use criteria for eligibility that are similar to the criteria used for the PDS. These include Food For Work, Annapurna, Integrated Child Development Services (ICDS), and the Midday Meal Schemes, each of which supply households with food items and might alter diet choice. In order to rule out the effect of changes to these programs, we restrict our sample to households that receive no other types of public support tracked by the NSSO consumer expenditure surveys. Column (4) of Table 8 demonstrates that it is unlikely that our results are an artifact of improvements in other forms of public assistance. The estimate is nearly identical in magnitude to the baseline estimates in Table 5, and is more precise.

Fourth, we use the delayed implementation of the PDS (Control) Order of 2004 to provide further evidence that the increased availability of PDS rice is driving our baseline results. The PDS (Control) Order discontinued the operation of private FPSs in December 2004. However, implementation of the Order was delayed until the resolution of a Supreme Court case in September 2005 (Patnaik 2005). This uncertainty led to a

sharp drop in PDS rice consumption between 2004 and 2005 (Krishnamurthy, Pathania, and Tandon 2014). It is likely that, during this period of uncertainty, privately-run FPSs discontinued operation before the FPSs could be turned over to the Gram Panchayats, co-operative societies, self-help groups, and forest protection committees that were permitted to operate them. The fraction of households in Chhattisgarh consuming PDS rice fell from .19 in 2004 to .15 in 2005, a decline of 21 percent. Daily consumption of PDS rice calories per household fell from 772 in 2004 to 508 in 2005, a decline of 34 percent.[47] In contrast, there was no change in PDS rice consumption in districts bordering Chhattisgarh from 2004 to 2005. This difference between Chhattisgarh and border districts cannot be explained by observable characteristics in the households surveyed in 2004 and 2005.[48]

We should therefore expect the increase in non-grains consumption in Chhattisgarh to be higher for households surveyed in 2004 than for those surveyed in 2005 if the consumption changes were being driven by increased access to FPSs. Columns (5) and (6) of Table 8, which restrict the post survey to households surveyed in 2004 and 2005, respectively, are consistent with this hypothesis. The estimate in column (5) of Table 8 is larger than the baseline estimate in Table 5 and more precisely estimated. In contrast, the magnitude of the estimate in column (6) of Table 8 is smaller than the baseline estimate in Table 5 and less precisely estimated.

Fifth, we provide evidence that our results are not common to all newly-formed states in India. It is possible that newer and smaller states have fewer entrenched interests and smaller oversight costs. The better overall governance in these states could improve public services such as the PDS and result in higher non-grains consumption. If these factors are decisive, then we should expect to observe similar patterns of growth in non-grains consumption in the newly-formed states of Jharkhand and Uttarkhand. These states were formed at the same time as Chhattisgarh, were also separated from large and

[47]Despite this decline, PDS rice consumption in Chhattisgarh was still much higher in 2005 than in 1999/2000.

[48]The 2004/2005 consumer expenditure survey was conducted from June 2004 to June 2005. The stratification of households surveyed between June-December 2004 and January-June 2005 was identical. This was most likely done to avoid issues with seasonality.

relatively poor states, and are approximately the same size as Chhattisgarh.[49]

Neither Jharkhand nor Uttarakhand, however, had higher growth in non-grains consumption than the districts bordering each state. Columns (7) and (8) of Table 8 report the differences in growth for Jharkhand and Uttarakhand, respectively, using the baseline specification. The estimate is negative in column (7) and positive in column (8), the magnitude of each is lower than the baseline estimates in Table 5, and neither is statistically significant at conventional levels.[50]

Finally, we provide evidence that the trends in non-grains consumption in districts that would become Chhattisgarh and border districts were similar prior to the PDS reforms in Chhattigarh. Table 9 demonstrates that growth in non-grains consumption only increased in Chhattisgarh relative to border districts after the PDS reforms were implemented. Columns (1)-(3) of Table 9 estimate the baseline specification for the growth of non-grains consumption between 1997 (53'rd Round) and 1998 (54'th Round), and columns (4)-(6) do so between 1998 and 1999/2000 (55'th Round). The coefficients in columns (1)-(6) of Table 9 are all lower in magnitude than the estimates presented in Tables 5-8, and none are statistically significant at conventional levels.

Column (7) of Table 9 combines all surveys conducted prior to the PDS reforms (53'rd and 54'th "thin" Rounds) with the two surveys used in the baseline analysis (55'th and 61'st "thick" Rounds) and estimates the difference in non-grains consumption growth between Chhattisgarh and border districts for each period. The estimate for the period corresponding to Chhattisgarh's PDS reforms (.208) is similar to the baseline estimate, and there is still little difference in the growth of non-grains consumption between Chhattisgarh and border districts in periods before the PDS reforms.

## 7. Conclusion

This article analyzes changes in diet choice in Chhattisgarh relative to border districts following PDS reforms that dramatically increased the availability of PDS food grains in

[49] Jharkhand was separated from Bihar and Uttarakhand was separated from Uttar Pradesh

[50] There is also no difference in growth of non-grains consumption between either Jharkhand or Uttarakhand and districts bordering Chhattisgarh.

the state. We find that relative to border districts, households in Chhattisgarh increased their calorie consumption from pulses, produce, and animal-based protein (non-grains consumption). These results appear to be driven by households in Chhattisgarh that were entitled to the largest food subsidies through PDS ration cards. We do not find evidence that households in Chhattisgarh without any entitlement to PDS subsidies changed their non-grains consumption relative to households in border districts. We also find that these changes in non-grains consumption are not a consequence of improvements to other forms of public assistance that target nutrition.

These results have implications for the recent improvement in PDS delivery in a number of Indian states (Khera 2011a). Our findings suggest that this improvement could have been accompanied by an improvement in non-grains consumption. Our results also suggest that the proposed expansion of the PDS under the NFSA could help to reduce persistent malnourishment and food insecurity in the country.

The analysis still leaves a number of questions unanswered. We do not know whether other forms of aid might be more effective at improving non-grains consumption than a large grains subsidy. Other forms of aid include subsidies for more nutritious foods, food stamps, and even cash subsidies. Although our results demonstrate that subsidizing staple grains can lead to other nutritional improvements, it is possible that direct subsidies for other types of foods may have a larger effect on nutritional outcomes. Chhattisgarh, in its most recent PDS reform in 2012, created a statewide subsidy for pulses after implementing a successful pilot program.

This article does not consider the potential adverse effects of PDS procurement of food grains on agricultural markets. Many commentators suggest that the government-mandated Minimum Support Price (MSP) does more to provide income support to farmers than to stabilize food prices (Rakshit 2003). Some studies suggest that these interventions in agricultural markets depress investment in the agricultural sector (Parikh, Ganesh-Kumar, and Darbha 2003). The effects of government procurement on agricultural markets are likely to be magnified as a result of increased procurement under the NFSA. A number of policy makers are therefore concerned about the NFSB's implications

for agricultural markets (Gulati, Gujral, and Nandakumar 2012).

Lastly, we do not have a definitive explanation for why the effects of food assistance on nutrition in this setting differ from other settings. It is possible that the differences between our results and those of Tarozzi (2005) are driven by differences in stages of development of the treated populations. Households in Chhattisgarh are likely to be poorer than those in Andhra Pradesh.[51] Consistent with this explanation, households in Chhattisgarh responded to a grains subsidy by primarily substituting towards pulses, which are a cheaper source of calories than both produce and animal-based protein. If households were richer and pulses already composed a high share of their diet, then they might prefer to consume more non-food goods or less nutritious foods, rather than increasing their consumption of produce or animal-based protein. More research is needed to arrive at a deeper understanding of the generalizability of these results.

[51] Estimates of both calorie consumption and monthly per capita expenditure in Chhattisgarh are lower than most other states in India (National Sample Survey Organization 2007).

## References


Abadie, Alberto, David Drukker, Jane Herr, and Guido Imbens. 2004. "Implementing Matching Estimators for Average Treatment Effects in Stata." *The Stata Journal* 4 (3), 290-311.

Abadie, Alberto and Guido Imbens. 2008. "On the Failure of the Bootstrap for Matching Estimators." *Econometrica* 76 (6), 1537-1557.

Ahluwalia, Deepak. 1993. "Public Distribution of Food in India: Coverage, Targeting, and Leakages." *Food Policy* 18 (1), 33-54.

Alderman, Harold and Joachim von Braun. 1984. "The Effects of the Egyptian Food Rationing and Subsidy System on Income Distribution and Consumption." Research Report No. 45, International Food Policy Research Institute.

Alderman, Harold, M. Ghaffar Chaudhry, and Marito Garcia. 1988. "Food Security in Pakistan: The Ration Shop System." Working Papers in Food Subsidies No. 4, International Food Policy Research Institute.

Barrett, Christopher. 2002. "Food Security and Food Assistance Programs," in *Handbook of Agricultural Economics* vol. 2 (B), eds. B. Gardner and G. Rauser, 2103-2190. Amsterdam: Elsevier.

Basu, Kaushik. 2011. "India's Foodgrain Policy: An Economic Theory Perspective." *Economic and Political Weekly* 46 (5), 37-46.

Beatty, Timothy and Charlotte Tuttle. 2012. "Expenditure Response to Increases in In-Kind Transfers: Evidence from the Supplemental Nutrition Assistance Program." Paper presented at the Agricultural and Applied Economics Association Food Environment Symposium, May 30-31.

Behrman, Jere and Anil Deolalikar. 1988. "Health and Nutrition," in *Handbook of Development Economics* Vol. 1, eds. Hollis Chenery and T.N. Srinivasan, 633-711. Amsterdam: North-Holland.

Behrman, Jere and Anil Deolalikar. 1989. "Is Variety the Spice of Life? Implications for Calorie Intake." *Review of Economics and Statistics* 71 (4), 666-672.

Block, Steven A., Lynnda Kiess, Patrick Webb, S. Kosen, Regina Moench-Pfanner, Martin W. Bloem, C. Peter Timmer. 2004. "Macro Shocks and Micro Outcomes: Child Nutrition During Indonesia's Crisis." *Economics and Human Biology* 2(1), 21-44.

Blundell, Richard and Monica Costa-Dias. 2000. "Evaluation Methods for Non-Experimental Data." *Fiscal Studies* 21 (4), 427-468.

Brinkman, Henk-Jan, Saskia de Pee, Issa Sanogo, Ludovic Subran, and Martin Bloem. 2009. "High Food Prices and the Global Financial Crisis Have Reduced Access to Nutritious Food and Worsened Nutritional Status and Health." *Journal of Nutrition* 140(1), 153-161.

Cameron, Colin, Jonah Gelbach, and Douglas Miller. 2008. "Bootstrap-Based Improvements for Inference with Clustered Errors." *The Review of Economics and Statistics* 90 (3), 414-427.

Deaton, Angus and Jean Dreze. 2009. "Food and Nutrition in India: Facts and Interpretations." *Economic and Political Weekly* 44 (7), 42-65.

Dev, S. Mahendra and M. H. Suryanarayana. 1991. "Is PDS Urban Biased and Pro-Rich? An Evaluation." *Economic and Political Weekly* 26 (4), 2357-2366.

Devaney, Barbara and Robert Moffitt. 1991. "Dietary Effects of the Food Stamp Program." *American Journal of Agricultural Economics* 73, 202-211.

Dreze, Jean and Reetika Khera. 2010. "Chhattisgarh shows the way." *The Hindu*, November 13. http://www.hindu.com/mag/2010/11/14/stories /2010111450010100.htm.

Dreze, Jean and Reetika Khera. 2011. "PDS Leakages: the Plot Thickens." *The Hindu*, August 12. http://www.thehindu.com/opinion/lead/pds-leakages-the-plot-thickens/article2351414.ece

Dutta, Bhaskar, and Bharat Ramaswami. 2001. "Targeting and Efficiency in the Public Distribution System: the Case of Andhra Pradesh and Maharashtra." *Economic and Political Weekly* 5, 1524-1532.

Edirsinghe, Neville. 1987. "The Food Stamp Scheme in Sri Lanka: Costs, Benefits, and Options for Modification." Research Report No. 58, International Food Policy Research Institute.

FAO. 2012a. "The State of Food Insecurity in the World, 2012." Research Report, Food and Agriculture Organization of the United Nations.

FAO. 2012b. "International Scientific Symposium on Food and Nutrition Security: from Valid Measurement to Effective Decision Making." Research Report, Food and Agriculture Organization of the United Nations.

Fan, Shenggen. 2012. "Food Policy in 2012: Walk the Talk." Research Report, International Food Policy Research Institute.

Government of Chhattisgarh. 2012. *Food Security Act, 2012*. Raipur, Chhattisgarh.

Fraker, Thomas. 1990. "The Effects of Food Stamps on Food Consumption: A Review of the Literature." Report, U.S. Department of Agriculture Food and Nutrition Service.

Fraker, T., A. Martini, and J. Ohls. 1995. "The Effect of Food Stamp Cashout on Food Expenditures: An Assessment of the Findings from Four Demonstrations." *Journal of Human Resources* 30, 633-649.

Gavan, James and Indrani Chandrasekera. 1979. "The Impact of Public Foodgrain Distribution on Food Consumption and Welfare in Sri Lanka." Research Report No. 13, International Food Policy Research Institute.

Gopalan, C., B.V. Rama Sastri, and S.C. Balasubramanian. 1989. *Nutritive Value of Indian Foods*. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research.

Government of India. 2006. "Best Practices Adopted and New Initiatives Taken in Strengthening of Targeted Public Distribution System in Some States/UTs of India." Report, Department of Food and Public Distribution.

Gulati, Ashok, Jyoti Gujral, and T. Nandakumar. 2012. "National Food Security Bill: Challenges and Options." Discussion Paper No. 2, Commission for Agricultural Costs and prices, Ministry of Agriculture, Government of India.

Howes, Stephen and Shikha Jha. 1992. "Urban Bias in the Indian Public Distribution System." *Economic and Political Weekly* 27 (19), 1022-1030.

Hoynes, Hillary and Diane Whitmore Shazenbach. 2009. "Consumption Responses to In-Kind Transfers: Evidence from the Introduction of the Food Stamp Program." *American Economic Journal: Applied Economics* 1 (4), 109-139.

Indrakanth, S. 1997. "Coverage and Leakages in PDS in Andhra Pradesh." *Economic and Political Weekly* 32 (19), 999-1001.

Jensen, Robert and Nolan Miller. 2011. "Do Consumer Price Subsidies Really Improve Nutrition?" *Review of Economics and Statistics* 93 (4), 1205-1223.

Jha, Shikha and Bharat Ramaswami. 2010. "The Percolation of Public Expenditure: Food Subsidies and the Poor in India and the Philippines." Indian Statistical Institute, Planning Unit, New Delhi Discussion Papers 11-14.

Kaushal, Neeraj and Felix Muchomba. 2013. "How Consumer Price Subsidies Affect Nutrition." National Bureau of Economic Research Working Paper 19404.

Kennedy, Eileen and Harold Alderman. 1987. "Comparative Analyses of Nutritional Effectiveness of Food Subsidies and Other Food-Related Interventions." Report, International Food Policy Research Institute.

Khera, Reetika. 2011a. "Trends in Diversion of Grain from the Public Distribution System." *Economic and Political Weekly* 46 (21).

Khera, Reetika. 2011b. "Revival of the Public Distribution System: Evidence and Explanations." *Economic and Political Weekly* 46 (44).

Kochar, Anjini. 2005. "Can Targeted Food Programs Improve Nutrition? An Empirical Analysis of India's Public Distribution System." *Economic Development and Cultural Change* 54 (1), 203-235.

Krishnamurthy, Prasad, Vikram Pathania, and Sharad Tandon . 2014. "Public Distribution System Reforms and Consumption in Chhattisgarh" *Economic and Political Weekly* 49 (8) 74-81.
/facultyProfile.php?facID=14129"

Levedahl, J. William. 1991. "The Effect of Food Stamps on Household Food Expenditures." Report, U.S. Department of Agriculture, Economic Research Service.

Lewit, Eugene and Nancy Kerrebrock. 1997. "Population Based Growth Stunting." *Future of Children* 7(2), 149-156.

Majumder, Bhasker. 2001. "Public Distribution System of Essential Commodities as a

Social Safety Net." Planning Commission, Government of India, Delhi, 2001.

Meade, Birgit and Stacey Rosen. 2013. "International Food Security Assessment, 2013-2023." U.S. Department of Agriculture, Economic Research Service, International Agriculture and Trade Outlook No. GFA-24.

Ministry of Consumer Affairs, Food, and Distribution. 2002. "High Level Committee Report on Long Term Grain Policy." Report, Ministry of Consumer Affairs, Food, and Distribution.

Mooij, Jos. 1999. *Food Policy and the Indian State: The Public Distribution System in South India.* Delhi: Oxford University Press.

National Institute of Nutrition. 2010. "Dietary Guidelines for Indians: A Manual." Report, National Institute of Nutrition, Government of India.

National Sample Survey Organization. 2007. "Nutritional Intake in India 2004-2005." Ministry of Statistics and Programme Implementation, Report No. 513.

Parikh, Kirit. 1994. "Who Gets How Much from the PDS: How Effectively Does it Reach the Poor." *Sarvekshana* 27 (3), 1-37.

Parikh, Kirit, A Ganesh-Kumar, and Gangadhar Darbha. 2003. "Growth and Welfare Consequences of Rise in MSP." *Economic and Political Weekly* 38 (18), 891-895.

Patnaik, A.K. 2005. "Order of the High Court of Chhattisgarh." Writ Petition No. 1397 of 2005, Chhattisgarh High Court.

Planning Commission. 2005. "Programme Evaluation of Targeted Public Distribution System." Report, Planning Commission, Government of India.

Government of Chhattisgarh. 2004. *Public Distribution System (Control) Order 2004.* Raipur, Chhattisgarh.

Puri, Raghav. 2012. "Reforming the Public Distribution System: Lessons from Chhattisgarh." *Economic and Political Weekly* 47 (5).

Radhakrishna, R., K. Subbarao, S. Indrakanth, and C. Ravi. 1997. "India's Public Distribution System: A National and International Perspective." World Bank Discussion Paper No. 380.

Rakshit, Mihir. 2003. "Some Analytics of Medium and Long Term Food Policy." *Economic and Political Weekly* 38 (18), 1777-1794.

Ranney, Christine and John Kushman. 1987. "Cash Equivalence, Welfare Stigma, and Food Stamps." *Southern Economic Journal* 53, 1011-1027.

Rao, Vijayendra. 2000. "Price Heterogeneity and "Real" Inequality: A Case Study of Prices and Poverty in Rural South India." *The Review of Income and Wealth* 46 (2), 201-211.

Sharma, Vijay. 2012. "Food Subsidy in India: Trends, Causes and Policy Reform Options." Indian Institute of Management, Ahmedabad, Working Paper No. 2012-08-02.

Sinha, Dipa. 2012. "Why the NFSA Will Not Ensure Nutrition Security." Center for

Legislative Research and Advocacy Policy Brief Series No. 15.

Smith, Jeffrey and Petra Todd. 2005. "Does Matching Overcome LaLonde's Critique of Nonexperimental Estimators?" *Journal of Econometrics* 125 (1), 305-353.

Tarozzi, Alessandro. 2005. "The Indian Public Distribution System as a Provider of Food Security: Evidence from Child Nutrition in Andhra Pradesh." *European Economic Review* 49, 1305-1330.

Wirt, Annika, and Clare Collins. 2009. "Diet Quality- what is it and does it matter?" *Public Health Nutrition* 12 (12), 2493-2503.

**Table 1. Timeline of Major PDS Reforms in Chhattisgarh since 2000**

| Reforms Instituted Before Raman Singh-Led Government (2000-2003) | | |
|---|---|---|
| Year | Reform | Description |
| 2001 | Sarvajanik Nagrik Poorti Vitran Scheme | Allowed private participation in the distribution of PDS commodities. |
| 2002 | Decentralized Procurement Scheme | Allowed the state government to procure rice directly from farmers. |

| Reforms Instituted by Raman Singh-Led Government (2004 onwards) | | |
|---|---|---|
| **Year** | **Reform** | **Description** |
| 2004 | Public Distribution System (Control) Order 2004 | De-privatized FPSs, instituted a number of transparency and auditing mechanisms to the distribution of food grains. |
| 2007 | List price reduction | Offered PDS food grains below the Central Issue Price. |
| 2007 | Mukhyamantri Khadyann Sahayata Yojana Scheme | Increased the number of people entitled to the most preferential PDS subsidies. |

Note: This table summarizes reforms to the PDS in Chhattisgarh between 2000 and 2009/2010 and was replicated from Krishnamurthy, Pathania, and Tandon (2013). The top panel lists reforms instituted by the Ajit Jogi-led government; the bottom panel lists reforms instituted by the Raman Singh-led government. For reforms in neighboring states, we refer readers to Khera (2011a).

**Table 2. Summary Statistics for Chhattisgarh and Border Districts by Survey**

| | 1999/2000 | 2004/2005 |
|---|---|---|
| Food Consumption | (1) | (2) |
| Daily per Capita Calories from Pulses, Produce, and Animal-Based Protein | 300.7 (540.2) | 282.4 (362.2) |
| Share of Grains in Overall Calories | 0.751 (0.148) | 0.760 (0.146) |
| Household-Level Controls | | |
| ln (Number of Meals Consumed Out of Home) | 0.595 (1.30) | 1.11 (1.61) |
| ln (non-Food Expenditure) | 6.07 (0.600) | 6.15 (0.642) |
| Share of Households Consuming Other PDS Commodities (Kerosene or Sugar) | 0.767 (0.423) | 0.644 (0.479) |
| Share of Households with a BPL card | - | 0.310 (0.462) |
| Share of Households with a non-BPL card | - | 0.312 (0.464) |
| Share of Households with no Ration Card | - | 0.378 (0.485) |
| Share of Households that are Self-Employed | 0.150 (0.357) | 0.246 (0.431) |
| Share of Households that are Rural | 0.703 (0.457) | 0.729 (0.445) |
| Share of Households that Belong to a Scheduled Caste | 0.148 (0.355) | 0.147 (0.354) |
| Share of Households that Belong to a Scheduled Tribe | 0.269 (0.444) | 0.267 (0.442) |
| Share of Households that are Hindu, Sikh, Jain, or Buddhist | 0.943 (0.232) | 0.939 (0.239) |
| Share of Households that are Muslim | 0.030 (0.171) | 0.028 (0.165) |
| Share of Households that are Christian | 0.027 (0.161) | 0.033 (0.179) |
| Observations | 5608 | 6790 |

Notes: This table presents summary statistics of household diet choice and household-level controls used in the empirical analysis. Variable means are presented for each time period, and the standard deviation is presented in parentheses. The data from 1999/2000 are from the 55'th Round of the Consumer Expenditure Survey, and the data from 2004/2005 are from the 61'st Round of the Consumer Expenditure Survey.

**Table 3. Average Non-Grains Consumption and Household Characteristics in Chhattisgarh and Border Districts Prior to the PDS Reforms**

| | Average in Chhattisgarh in 1999/2000 | Average in Border Districts in 1999/2000 | Difference (Col. 1 – Col. 2) |
|---|---|---|---|
| | (1) | (2) | (3) |
| ln (Calories from Pulses, Produce, and Animal-Based Protein) | 8.67 | 8.77 | -0.096 |
| | (0.022) | (0.018) | (0.111) |
| Share of Grains in Overall Calories | 0.757 | 0.747 | 0.011 |
| | (0.003) | (0.002) | (0.013) |
| ln (Number of Meals Consumed Out of Home) | 0.591 | 0.598 | -0.006 |
| | (0.028) | (0.022) | (0.118) |
| ln (non-Food Expenditure) | 6.07 | 6.07 | -0.001 |
| | (0.043) | (0.054) | (0.068) |
| Share of Households Consuming Other PDS Commodities (Kerosene or Sugar) | 0.799 | 0.744 | 0.055 |
| | (0.008) | (0.008) | (0.037) |
| Share of Households that are Self-Employed | 0.147 | 0.152 | -0.005 |
| | (0.007) | (0.006) | (0.013) |
| Share of Households that are Rural | 0.707 | 0.701 | 0.006 |
| | (0.010) | (0.008) | (0.053) |
| Share of Households that Belong to a Scheduled Caste | 0.139 | 0.154 | -0.015 |
| | (0.007) | (0.006) | (0.027) |
| Share of Households that Belong to a Scheduled Tribe | 0.263 | 0.274 | -0.010 |
| | (0.009) | (0.008) | (0.074) |
| Share of Households that are Hindu, Buddhist, Sikh, or Jain | 0.955 | 0.935 | 0.019 |
| | (0.004) | (0.004) | (0.015) |
| Share of Households that are Muslim | 0.028 | 0.032 | -0.004 |
| | (0.003) | (0.003) | (0.009) |
| Share of Households that are Christian | 0.017 | 0.033 | -0.016 |
| | (0.003) | (0.003) | (0.016) |
| Observations | 2292 | 3316 | - |

Notes: This table reports summary statistics of non-grains consumption and household characteristics in the 1999/2000 NSSO consumer expenditure survey, prior to the formation of Chhattisgarh, that are used as control variables in the empirical analysis. Column (1) reports average characteristics in Chhattisgarh; column (2) reports average characteristics in border districts; and column (3) reports the difference between the two regions. Standard errors clustered by district are presented in parentheses. For the differences presented in the third column, statistical significance is reported where *** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5% level, and * denotes statistical significance at the 10% level.

**Table 4. Differences in Consumption in Chhattisgarh and Border Districts between 1999/2000 and 2004/2005**

| | Difference in Daily per Capita PDS Rice Calories | Difference in Daily per Capita Calories from Pulses | Difference in Daily per Capita Calories from Produce | Difference in Daily per Capita Calories from Animal-Based Protein | Difference in Daily per Capita Non-PDS Rice Calories |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Chhattisgarh | 111.8 | 11.5 | 5.65 | -6.28 | -139.1 |
| | (29.4) | (10.5) | (16.8) | (8.01) | (56.2) |
| Border Districts | 0.784 | -12.1 | -9.30 | -17.1 | -121.2 |
| | (18.3) | (4.80) | (7.65) | (14.2) | (55.8) |
| Difference | 111.0*** | 23.6** | 15.0 | 10.8 | -17.9 |
| (Row1 – Row2) | (32.8) | (10.8) | (17.4) | (15.9) | (76.2) |
| Observations | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 |

Notes: The first two rows report average differences in daily per capita food consumption by source between the 55'th round (1999/2000) and 61'st round (2004/2005) of the NSSO Consumer Expenditure surveys for both Chhattisgarh and districts bordering the state. The third row presents the differences in the growth of consumption between Chhattisgarh and border districts. Standard errors clustered by district are presented in parentheses. For the differences presented in the third row, statistical significance is reported where *** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5% level, and * denotes statistical significance at the 10% level.

**Table 5. Differences in Growth of Non-Grains Consumption between Chhattisgarh and Border Districts**

| Dependent Variable: | ln(Daily per Capita Calories from Pulses, Produce, and Sources of Animal-Based Protein) | | | ln(Daily per Capita Calories from Pulses) | ln(Daily per Capita Calories from Produce) | ln(Daily per Capita Calories from Sources of Animal-Based Protein) | ln(Daily per Capita Calories from Non-PDS Rice | Share of Grains in Overall Calories |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| CT*Post | 0.137 | 0.190* | 0.130** | 0.433** | 0.087 | 0.137 | 0.022 | 0.016* |
| | (0.124) | (0.105) | (0.063) | (0.206) | (0.063) | (0.153) | (0.156) | (0.008) |
| District Fixed Effects | N | Y | Y | Y | Y | Y | Y | Y |
| Control Variables | N | N | Y | Y | Y | Y | Y | Y |
| P-Value Using Wild Cluster Boot Strap | 0.138 | 0.087* | 0.018** | 0.109 | 0.11 | 0.436 | 0.966 | 0.194 |
| Observations | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 |

Notes: This table presents the difference-in-differences estimates for non-grains consumption between 1999/2000 and 2004/2005. Columns (1)-(3) estimate the baseline specification using the natural logarithm of daily per capita calories consumed from pulses, produce, and sources of animal-based protein as the dependent variable; columns (4)-(6) separate specifications by types of calories; column (7) estimates the baseline specification using the natural logarithm of non-PDS rice calories as the dependent variable; and column (8) estimates the baseline specification using the share of grains in overall calorie consumption as the dependent variable. Control variables include an indicator equaling one if the household was surveyed in the post-period, the natural logarithm of number of meals consumed outside the household, the natural logarithm of non-food expenditure, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). For specifications without district fixed effects, control variables also include an indicator equaling one if the household resided in Chhattisgarh. Standard errors clustered by district are reported in parentheses. All specifications also report p-values of the coefficient on the interaction of the Chhattisgarh indicator and a Post variable using the wild cluster-bootstrap percentile-t method to estimate standard errors clustered by state. * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table 6. Differences in Growth of Nutrient Consumption between Chhattisgarh and Border Districts**

| | ln(Daily per Capita Consumption of Total Calories) | ln(Daily per Capita Consumption of Protein) | ln(Daily per Capita Consumption of Minerals) | ln(Daily per Capita Consumption of Iron) | ln(Daily per Capita Consumption of Calcium) | ln(Daily per Capita Consumption of Fiber) |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| CT*Post | 0.056 | 0.129** | 0.097 | 0.142** | 0.264*** | 0.031 |
| | (0.072) | (0.063) | (0.062) | (0.064) | (0.094) | (0.122) |
| Obs. | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 | 12,398 |

Notes: This table reports the difference-in-differences estimate for daily per capita consumption of nutrients between 1999/2000 and 2004/2005. All specifications include district fixed effects and control variables. Control variables include an indicator equaling one if the household was surveyed in the post-period, the natural logarithm of number of meals consumed outside the household, the natural logarithm of non-food expenditure, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table 7. Baseline Estimates Separated by Type of Ration Card**

Dependent Variable:
ln(Daily per Capita Calories from Pulses, Produce, and Sources of Animal-Based Protein)

| | Restrict Sample to Households with Proxied Ration Cards | Restrict Sample to Households without Proxied Ration Cards | Restrict Households in Post- Survey to those with BPL Cards | | Restrict Households in Post- Survey to those with Other Cards | | Restrict Households in Post- Survey to those with No Ration Card | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| CT*Post | 0.222** | 0.076 | 0.158*** | 0.243*** | 0.088 | 0.050 | 0.071 | -0.035 |
| | (0.106) | (0.128) | (0.049) | (0.080) | (0.075) | (0.081) | (0.134) | (0.156) |
| Exclude Households from States Most Dissimilar to Chhattisgarh | N | N | N | Y | N | Y | N | Y |
| Obs. | 5590 | 6808 | 7712 | 4308 | 7730 | 4726 | 8172 | 4654 |

Notes: This table reports the difference-in-differences estimate for daily per capita calories from pulses, produce, and sources of animal-based protein between 1999/2000 and 2004/2005 separated by types of subsidies to which households are entitled. Columns (1) restricts the sample to households in the pre-period that consume any PDS rice and households that have a ration card in the post-period; column (2) restricts the sample to households that consume no PDS rice in the pre-period and households that do not have a ration card in the post-period; columns (3) and (4) restrict the sample to households with a BPL ration card in the post-period; columns (5) and (6) restrict the sample to households with a non-BPL ration card in the post-period; and columns (7) and (8) restrict the sample to households without a ration card in the post-period. Columns (4), (6), and (8) exclude households residing in the states that are the most dissimilar to Chhattisgarh in terms of non-grains consumption and expenditure- Andhra Pradesh, Maharashtra, Orissa, and Uttar Pradesh; all other columns include the entire sample. All specifications include district fixed effects and control variables. Control variables include an indicator equaling one if the household was surveyed in the post-period, the natural logarithm of number of meals consumed outside the household, the natural logarithm of non-food expenditure, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table 8. Robustness Checks of Baseline Specification**

Dependent Variable: ln(Daily per Capita Calories from Pulses, Produce, and Sources of Animal-Based Protein)

| | Variations of Baseline Specification | | | | | | Placebo Specifications | |
|---|---|---|---|---|---|---|---|---|
| | Difference between Chhattisgarh and all of Madhya Pradesh | Difference between Chhattisgarh and all of India | Difference between Chhattisgarh and States where the PDS Functioned Well | Restrict Sample to Households not Receiving Other Forms of Public Benefits | Restrict Post-Survey to Households Surveyed in 2004 | Restrict Post-Survey to Households Surveyed in 2005 | Difference between Jharkhand and Border Districts | Difference between Uttarakhand and Border Districts |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| CT* Post | 0.105** | 0.105* | 0.152* | 0.151** | 0.187** | 0.066 | -0.067 | 0.030 |
| | (0.052) | (0.058) | (.082) | (0.068) | (0.075) | (0.086) | (0.059) | (0.060) |
| Obs. | 16,998 | 243,273 | 7860 | 9860 | 8996 | 9010 | 15,277 | 7433 |

Notes: This table reports the difference-in-differences estimate for daily per person calorie consumption from pulses, produce, and sources of animal-based protein between 1999/2000 and 2004/2005. Columns (1) - (3) re-estimate the baseline specification but utilize different subsets of households for the comparison region. Column (1) utilizes all households from Madhya Pradesh, column (2) utilizes all households from all of India, and column (3) utilizes households in Andhra Pradesh and Maharashtra (states where the PDS functions well). Column (4) re-estimates the baseline specification, but restricts the sample to households that do not receive any other public benefit tracked by the NSSO. Columns (5) and (6) re-estimate the baseline specification but restrict the sample in the post-survey to households surveyed in 2004 and 2005, respectively. Columns (7) and (8) report placebo specifications which estimate the difference in consumption growth between the other newly-formed states of Jharkhand and Uttarakhand and districts bordering each state. All specifications include district fixed effects and control variables. Control variables include an indicator equaling one if the household was surveyed in the post-period, the natural logarithm of number of meals consumed outside the household, the natural logarithm of non-food expenditure, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table 9. Trends in Non-Grains Consumption Prior to the Formation of Chhattisgarh**

Dependent Variable:
ln(Daily per capita calories from pulses, produce, and sources of animal-based protein)

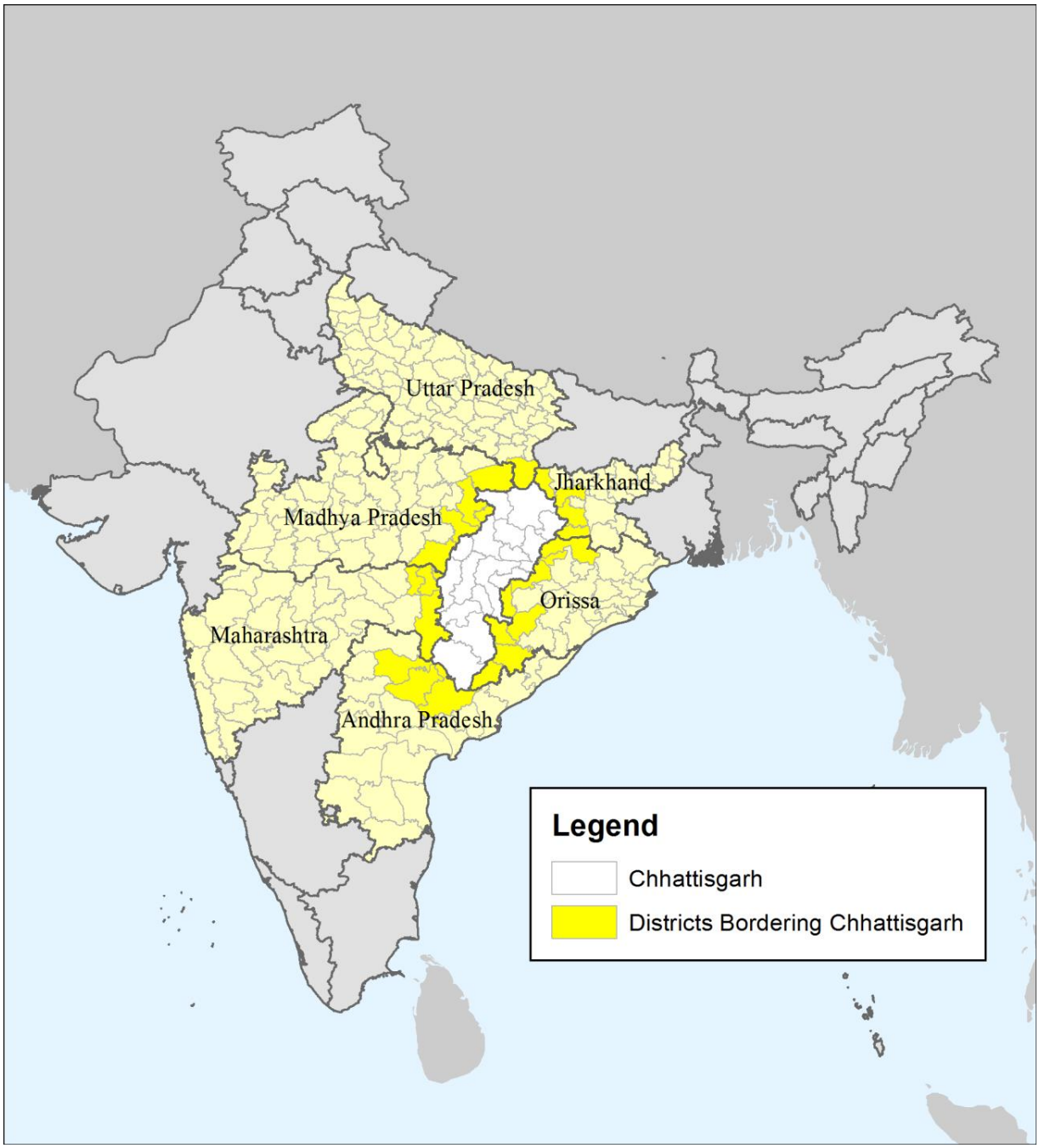
| | Difference between 1997 and 1998 | | | Difference between 1998 and 1999 | | | Full Sample |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| $CT*Post_{t-2}$ | 0.017 | 0.067 | 0.090 | - | - | - | 0.090 |
| | (0.122) | (0.115) | (0.095) | | | | (0.091) |
| $CT*Post_{t-1}$ | - | - | - | -0.049 | -0.078 | -0.051 | 0.030 |
| | | | | (0.095) | (0.093) | (0.078) | (0.073) |
| $CT*Post_t$ | - | - | - | - | - | - | 0.208* |
| | | | | | | | (0.103) |
| District Fixed Effects | N | Y | Y | N | Y | Y | Y |
| Control Variables | N | N | Y | N | N | Y | Y |
| Observations | 4076 | 4076 | 4076 | 7022 | 7022 | 7022 | 16,474 |

Notes: This table reports the difference-in-differences estimate for non-grains consumption in periods prior to the PDS reforms in Chhattisgarh. Columns (1)-(3) present estimates of the difference-in-differences between 1997 (53'rd Round) and 1998 (54'th Round); columns (4)-(6) present estimates of the difference-in-differences between 1998 (54'th Round) and 1999 (55'th Round); and column (7) pools all surveys and estimates changes in consumption in Chhattisgarh relative to border districts at different time periods. Control variables include all variables included in the baseline specifications in Tables 5-7 that are available in all the surveys conducted in these prior years. Specifically, control variables include an indicator equaling one if the household was surveyed in the post-period, the natural logarithm of number of meals consumed outside the household, the natural logarithm of non-food expenditure, and indicators for whether the household resides in a rural area, for whether the household is self-employed, and for whether the household belongs to a Scheduled Caste or a Scheduled Tribe. In specifications not including district fixed effects, the control variables also include an indicator equaling one if the household resided in Chhattisgarh. Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Figure 1. Impacts of PDS Reforms in Chhattisgarh and Border Regions**


Notes: The top panel of the figure presents the number of Fair Price Shops per 1000 people in Chhattisgarh and states bordering Chhattisgarh; the middle panel presents the total amount of PDS rice procured in millions of metric tons by the state government in Chhattisgarh and states bordering Chhattisgarh; and the bottom panel presents daily per capita PDS rice calorie consumption in Chhattisgarh and districts bordering Chhattisgarh. The bottom panel is qualitatively identical if all households from bordering states are included. The top two figures are replicated from Krishnamurthy, Pathania, and Tandon (2013). The data are obtained from Annual Reports published by the Ministry of Consumer Affairs and from the report "Programme Evaluation of Targeted Public Distribution System," published by the Planning Commission in 2005. Data on the Fair Price Shops and state PDS rice procurement is not available at the district level from these sources. The bottom figure uses data from the 55'th and 61'st rounds of the consumer expenditure surveys conducted by the National Sample Survey Organization. States that border Chhattisgarh are Andhra Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Orissa, and Uttar Pradesh.

**Figure 2. Map of Chhattisgarh and Border Districts**




Notes: This figure presents a map of Chhattisgarh and districts bordering the state. Since the state formed in 2000, a small number of districts that had bordered Chhattisgarh split into two districts, one of which no longer borders the state in the 2004/5 survey. However, to be consistent, 1999/2000 boundaries are used and all regions that had bordered Chhattisgarh at that time are identified as border districts. The districts that border Chhattisgarh are listed as follows. From Andhra Pradesh- Karimnagar, Khammam, Warangal; from Jharkhand- Garhwa, Gumla, Simdega; from Maharashtra- Bhandara, Chandrapur; from Madhya Pradesh- Anuppur, Balaghat, Dindori, Shahdol, Sidhi, Singrauli; from Orissa- Bargarh, Jharsuguda, Kalahandi, Koraput, Malkangiri, Nabarangpur, Naupada, Sundargarh; and from Uttar Pradesh-Sonbhadra.

**Online Appendix**

In this section, we illustrate the assumptions necessary to obtain the desired estimate from specifications restricting the sample in the post-period to households with a particular type of ration card. Specifically, we are trying to estimate the difference-in-difference estimate of the change in non-grain calories in Chhattisgarh relative to bordering districts for BPL card holders. If we could identify BPL card holders in both the pre and post-periods, we would have computed the following double difference estimator for the BPL sample:

$$\begin{aligned} DD &= E[Y^T_{post,B} - Y^T_{pre,B}|X] - E[Y^C_{post,B} - Y^C_{pre,B}|X] \\ &= E[Y^T_{post,B} - Y^C_{post,B}|X] - E[Y^T_{pre,B} - Y^C_{pre,B}|X] \end{aligned} \tag{A1}$$

Here, $Y^s_{t,i}$ is the outcome of interest (i.e, non-grain calorie consumption) for the treatment ($T$) or control ($C$) states, in the period $t$ (pre or post) for group $i$ (BPL card holders ($B$) or others [$N$]). The second row is an equivalent way of expressing the double-difference estimator - it nets out the pre-period difference in levels between the treatment and control groups from the post-period difference, and attributes any residual change to the treatment.

However, we can only identify the BPL card holders in the post-period, and we estimate specifications in which we restrict the post-period sample to BPL card holders only (while keeping the entire pre-period sample which is a mix of BPL card holders and the others). Let $\alpha^T$ and $\alpha^C$ be the fraction of sampled households that do not own BPL cards in the treatment and control states respectively. Assume that these fractions remain the same in the pre and post-periods. Then our modified specification estimates the following double difference:

$$
\begin{aligned}
DD' &= E[Y^T_{post,B} - (\alpha^T Y^T_{pre,N} + (1-\alpha^T)Y^T_{pre,B})|X] \\
&\quad - E[Y^C_{post,B} - (\alpha^C Y^C_{pre,N} + (1-\alpha^C)Y^C_{pre,B})|X] \\
&= E[Y^T_{post,B} - Y^C_{post,B}|X] \\
&\quad - E[(Y^T_{pre,B} - \alpha^T(Y^T_{pre,N} - Y^T_{pre,B})) - (Y^C_{pre,B} - \alpha^C(Y^C_{pre,N} - Y^C_{pre,B}))|X]
\end{aligned} \tag{A2}
$$

The second decomposition of the modified estimator ($DD'$) as shown in the equation above is instructive. Once again, the pre-period difference in levels between the treatment and control group is being netted out of the post-period difference except for the fact that the pre-period difference is for the entire sample, which is a mix of BPL card holders and the others.

We can see the source of potential bias in $DD'$ when we compare the above expressions. While we estimate the same (conditional) post-period difference between the treatment and control group in both cases, we have different estimates of the pre-period difference. We can formalize the bias as follows:

$$
\begin{aligned}
\text{Bias} &= DD' - DD \\
&= E[\alpha^C(Y^C_{pre,N} - Y^C_{pre,B}) - \alpha^T(Y^T_{pre,N} - Y^T_{pre,B})|X]
\end{aligned} \tag{A3}
$$

There are a number of things to note about this expression. First, note that $\alpha^T, \alpha^C > 0$. Similarly, we expect that $E[Y^C_{pre,N} - Y^C_{pre,B}|X]$ and $E[Y^T_{pre,N} - Y^T_{pre,B}|X]$ to be positive since BPL card holders are among the poorest in the population. Therefore, both terms in equation are positive. The first term measures the *positive distortion* to the conditional mean $Y$ of the BPL card holders in the control states due to the fact that we are actually measuring the conditional mean of the entire sample (BPL and others.) This distortion is increasing in the share of the non-BPL card holders in the sample ($\alpha^C$), and the inter-group difference in means ($Y^C_{pre,N} - Y^C_{pre,B}$). The second term measures this distortion for the treatment state.

It is important to note that all the bias stems from mismeasurement in

the starting points for the double difference estimation. Intuitively if the starting point for the control states is more distorted than for the treatment state either because $\alpha^C > \alpha^T$ and/or because there is much more difference in mean $Y$ between the BPL card holders and others in the treatment state, then the modified estimator, $DD'$, picks that up as a large decline in the mean for the control states in the post period - a positive bias.

The strict condition for no bias requires that $\alpha^C = \alpha^T$ and that $(Y^C_{pre,N} - Y^C_{pre,B}|X) = (Y^T_{pre,N} - Y^T_{pre,B})|X]$. We choose households in districts bordering Chhattisgarh precisely because they are more similar to households in Chhattisgarh than the rest of India. Corroborating the similarity of households in Chhattisgarh and border districts, Figure A1 demonstrates that the distribution of non-grains consumption is almost identical in Chhattisgarh and border districts in the pre-period. Furthermore, Table A1 demonstrates that there is no statistical difference in the share of the sample with BPL cards in Chhattisgarh and border districts in the 2004/5 survey. Given a stay issued by the Supreme Court blocking the issuing of new BPL cards in rural areas until 2006, the distribution of ration cards in rural areas was the same in the pre and post-surveys and this result corroborates there being no difference in the share of the sample with BPL cards between regions in the pre-period. Additionally, based on the formal bias expression above, the similar distribution of non-grains consumption in the pre-period combined with fewer BPL card holders (not statistically significant) in Chhattisgarh potentially make the bias small and negative.

We further demonstrate the results are robust to the inclusion of district fixed effects, which helps to absorb the time-invariant factors that contribute to differences in the pre-treatment average non-grains consumption; we demonstrate the results are identical when we exclude border districts in the relatively rich states of Andhra Pradesh and Maharashtra, which are less similar to other regions in the analysis in terms of expenditures in the pre-period; and we demonstrate the results are identical when we exclude border districts that are most dissimilar in non-grains consumption in the pre-period. In specifications not shown, the results are identical when dropping border districts from any individual state, and the results are identical when we restrict the comparison to Chhattisgarh and border districts to each state individually, some of which have nearly identical consumption

of non-grains calories in the pre-period.

We also check and find that the difference in non-grains consumption between ration card holders and those without ration card holders is similar in Chhattisgarh and border districts, Table A2 presents estimates from the following specification:

(A4)

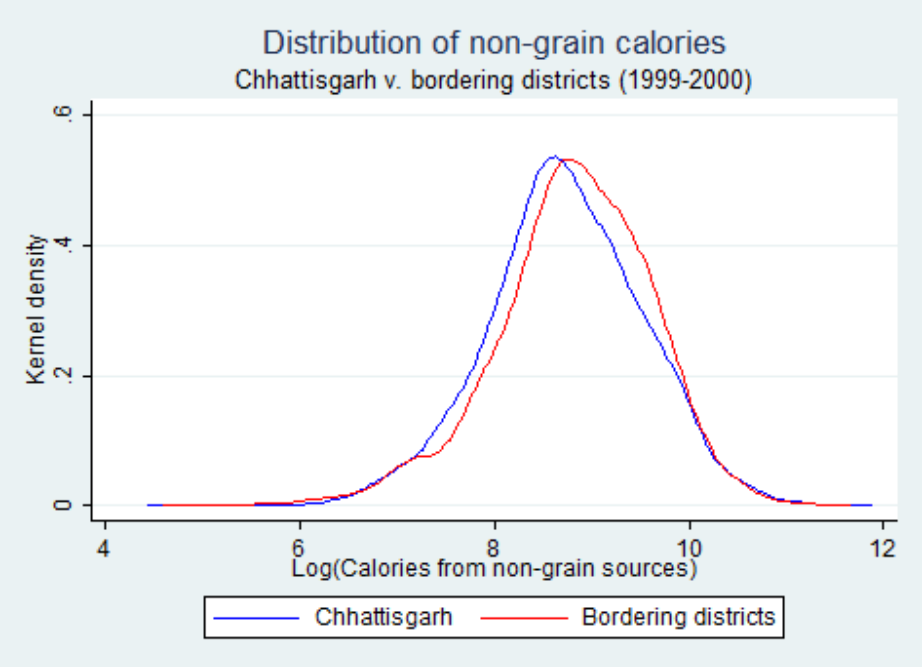
$$ln(NonGrains\_Calories_{id,1999}) = \kappa_d + \gamma CT_{id,1999} * Proxied\_Card_{id,1999} + \beta X_{id,1999} + \epsilon_{id,1999}$$

where d denotes 1999 district boundaries; $\kappa_d$ denotes district fixed effects; $NonGrains\_Calories$ denotes daily per capita calories consumed from pulses, sources of animal-based protein, and produce; $CT$ denotes an indicator equal to one if the household resided in the state; $Proxied\_Card$ denotes an indicator equal to one if the household consumed any PDS rice; and $X$ contains lower-order terms and control variables.[1] The variable of interest is $\gamma$, which gives an estimate of how much larger the difference in non-grains consumption between households with and without proxied ration cards is in Chhattisgarh than in border districts in the 1999/2000 survey.

Table A2 presents estimates of this specification. Column (1) estimates a sparse specification including only the variable of interest and lower-order terms; column (2) adds district fixed effects; and column (3) adds control variables. In all specifications, we cannot reject the hypothesis that the difference in non-grains consumption between households with and without a proxied ration card is identical in Chhattisgarh and border districts in the 1999/2000 survey. Furthermore, the magnitude of each estimate is small and the sign is not consistent across specifications.

[1]Controls include the natural logarithm of the number of meals consumed outside the household, the natural logarithm of monthly per capita expenditure, and indicators for whether a household resides in a rural area, for whether a household is self-employed, for whether a household has consumed any PDS commodity aside from food grains (i.e., kerosene and sugar) over the past thirty days, indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist), and indicators for whether a household belongs to a Scheduled Caste or a Scheduled Tribe.

**Figure A1: Distribution of Non-Grains Consumption in Chhattisgarh and Border Districts**




Note: This figure presents the distribution of consumption from pulses, produce, and animal-based protein in Chhattisgarh and border districts in 1999/2000. The data are obtained from the 55'th round of the consumer expenditure survey conducted by the National Sample Survey Organization.

**Table A1: Difference in the Share of the Sample that has a BPL Card in 2004/5 between Chhattisgarh and Border Districts**

| | Dependent Variable: Share of the Sample in 2004/5 Survey that has a BPL Card | | |
|---|---|---|---|
| | Pooled Sample | Rural | Urban |
| | (1) | (2) | (3) |
| CT Indicator | -0.049 | -0.063 | 0.0003 |
| | (0.041) | (0.049) | (0.037) |
| Observations | 6790 | 4947 | 1843 |

Notes: This table reports the simple difference in the share of the sample with BPL cards between Chhattisgarh and border districts in the 2004/5 consumer expenditure survey. Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table A2: Differences in Non-Grains Consumption between Households with and without Approximate Ration Cards in Chhattisgarh and Border Districts in 1999/2000**

| | Dependent Variable: ln (non-grains calories) | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| CT* Proxied Card | 0.052 | -0.058 | -0.070 |
| | (0.145) | (0.112) | (0.100) |
| District Fixed Effects | N | Y | Y |
| Control Variables | N | N | Y |
| Observations | 5608 | 5608 | 5608 |

Notes: This table reports the difference-in-differences of non-grains consumption between households with and without approximate ration cards in the 1999/2000 survey between households in Chhattisgarh and border districts. Households are defined to have an approximate ration card if they consume any PDS rice. Column (1) estimates a sparse specification including only the variable of interest and lower-order terms; column (2) adds district fixed effects; and column (3) adds control variables. Control variables include the Proxied Card indicator, the natural logarithm of number of meals consumed outside the household, the natural logarithm of Monthly per Capita Expenditure as calculated by the NSSO, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, two indicators for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). For specifications not including fixed effects, control variables also include an indicator equal to one if the household resided in Chhattisgarh. Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table A3: Matching Estimates of Differences in Non-Grains Consumption 1999/2000-2004/5**

| | Dependent Variable: ln (non-grains calories) | |
|---|---|---|
| | Chhattisgarh (1) | Border Districts (2) |
| Post | -0.016 | -0.131*** |
| | (0.029) | (0.023) |
| 95-Percent Confidence Interval | (-0.074, 0.041) | (-0.176, -0.086) |
| Observations | 5088 | 7310 |

Notes: This table reports the difference in non-grains consumption between 1999/2000 and 2004/5 for Chhattisgarh and border districts separately using the matching estimator proposed by Abadie et al. (2004). The estimates use the bias-corrected and robust options, and utilize four matches. Treatment is defined as the Post variable, and the control variables used in the baseline empirical specification are the matching variables. Specifically, the matching variables are the natural logarithm of number of meals consumed outside the household, the natural logarithm of Monthly per Capita Expenditure as calculated by the NSSO, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, two indicators for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). Most importantly, the estimated 95-percent confidence intervals of the two estimates do not overlap. * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table A4: Differences in Expenditure between households in Chhattisgarh and Border Districts between 1999/2000 and 2004/5**

| | Dependent Variable: ln(Monthly Per Capita Expenditure) | | | | | |
|---|---|---|---|---|---|---|
| | Restrict Sample to Cereals Producers | | | Entire Sample | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| CT* Post | -0.004 | 0.021 | 0.043 | 0.028 | 0.033 | 0.066 |
| | (0.088) | (0.080) | (0.079) | (0.086) | (0.079) | (0.079) |
| District Fixed Effects | N | Y | Y | N | Y | Y |
| Control Variables | N | N | Y | N | N | Y |
| Observations | 5592 | 5592 | 5592 | 12,398 | 12,398 | 12,398 |

Notes: This table reports the difference-in-differences estimate of how much more monthly per capita expenditure grew in Chhattisgarh than in border districts between 1999/2000 and 2004/5. Columns (1) and (4) estimate a sparse specification including only the variable of interest and lower-order terms; columns (2) and (5) add district fixed effects; and columns (3) and (6) add control variables. Control variables include the Post indicator, the natural logarithm of number of meals consumed outside the household, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, two indicators for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). For specifications not including fixed effects, control variables also include an indicator equal to one if the household resides in Chhattisgarh. Standard errors clustered by district are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.

**Table A5. 2004/5 PDS Rice Consumption by Type of Ration Card**

| | Chhattisgarh | | | Border Districts | | |
|---|---|---|---|---|---|---|
| | Households with BPL Ration Cards | Households with Other Ration Cards | Households with no Ration Card | Households with BPL Ration Cards | Households with Other Ration Cards | Households with no Ration Card |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Share of Sample Consuming any PDS Rice | 0.520 | 0.036 | 0.033 | 0.716 | 0.045 | 0.019 |
| | (0.061) | (0.009) | (0.010) | (0.060) | (0.014) | (0.006) |
| Average kilograms of PDS Rice Consumed | 31.1 | 18.6 | 22.2 | 18.6 | 16.8 | 24.3 |
| | (0.936) | (1.58) | (1.25) | (0.659) | (0.898) | (2.32) |

Notes: This table reports the share of households consuming any PDS rice and the average monthly consumption of those households separated by type of ration card held. Columns (1)-(3) report values for Chhattisgarh, while columns (4)-(6) report values for border districts. The allowances by type of ration card vary across states, but in Chhattisgarh, BPL households are entitled to 35 kgs/month, other types of ration cards are generally entitled to 25 kgs/month, and households without ration cards are not entitled to purchase PDS food grains. PDS consumption by non-ration card holders could be the result of measurement error, FPSs sold them grains by mistake, or another household's ration card was used to purchase the grains. All consumption figures are obtained from the 61'st round of the consumer expenditure survey conducted by the National Sample Survey Organization. Standard errors clustered by district are reported in parentheses.

**Table A6. Number of Households Sampled by State and Time in Chhattisgarh and Border Districts**

| | 1999-2000 | 2004-2005 |
|---|---|---|
| Chhattisgarh | 2292 | 2796 |
| Andhra Pradesh | 852 | 1010 |
| Jharkhand | 348 | 600 |
| Madhya Pradesh | 564 | 680 |
| Maharashtra | 444 | 466 |
| Orissa | 1002 | 1118 |
| Uttar Pradesh | 106 | 120 |
| Total | 5608 | 6790 |

Notes: This table presents the number of households from each survey used in the analysis, separated by time period and state. The data from 1999-2000 are from the 55'th Round of the Consumer Expenditure survey, and the data from 2004-2005 are from the 61'st Round of the Consumer Expenditure Survey. The observations for Chhattisgarh in 1999-2000 represent the number of observations in the districts that would later become Chhattisgarh.

**Table A7. Trends in PDS Rice Consumption in Chhattisgarh/Madhya Pradesh Relative to Border States 1993/1994-1999/2000**

| | Dependent Variable: Daily per Capita Calories from PDS Rice Consumption | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Chatt/MP*Post | -10.3 | -9.73 | -8.66 |
| | (18.9) | (19.1) | (19.1) |
| State Fixed Effects | N | Y | Y |
| Control Variables | N | N | Y |
| Observations | 108,854 | 108,854 | 108,854 |

Notes: This table reports the difference-in-differences estimate of daily per capita PDS rice consumption, comparing the growth in PDS rice consumption between 1993/1994 and 1999/2000 in Madhya Pradesh and districts that would later become Chhattisgarh to states that border the future state of Chhattisgarh. Chhattisgarh/MP denotes an indicator equal to one if the household resides in Madhya Pradesh or districts that would later form Chhattisgarh, and Post denotes an indicator equal to one if the observation comes from the 1999/2000 survey. All consumption figures are obtained from the 50'th and 55'th rounds of the consumer expenditure survey conducted by the National Sample Survey Organization. Standard errors clustered by state are reported in parentheses. Column (1) estimates a sparse specification with no fixed effects; column (2) adds state fixed effects; and column (3) adds control variables. Control variables include the Post indicator, the natural logarithm of number of meals consumed outside the household, and indicators for whether the household resides in a rural area, for whether the household purchased any type of commodity aside from food grains (i.e., sugar or kerosene) from the PDS, for whether the household is self-employed, two indicators for whether the household belongs to a Scheduled Caste or a Scheduled Tribe, and indicators for household religion (Muslim, Christian, Hindu/Sikh/Jain/Buddhist). For specifications not including fixed effects, control variables also include an indicator equal to one if the household resides in Madhya Pradesh or districts that would later form Chhattisgarh. Standard errors clustered by state are reported in parentheses; * Denotes significance at the 10% level; ** Denotes significance at the 5% level; *** Denotes significance at the 1% level.