Food Price Subsidies & Nutrition in India: Is Less Targeting more?

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Abstract: India's Public Distribution System (PDS) is the largest food-based social safety net in the world, and many in India argue that it should be universalized rather than targeted based on household income. We use a natural experiment to ask whether universalizing PDS in the Indian state of Odisha improved access to PDS entitlements and ultimately women's health. In 2008, the Odisha government simultaneously increased PDS entitlements and universalized access to the PDS in the particularly poor Kalahandi-Balangir-Koraput (KBK) region. In the rest of the state, the government increased PDS entitlements for poor households in an equivalent manner, but did not universalize PDS. We exploit this variation in reform implementation and find that while universalization had little effect on women's health (BMI) in above poverty line households, it improved health in below poverty line households. We also examine the mechanisms that drive improvements in health.

JEL Codes: O12, I15, I14

Benefits meant exclusively for the poor often end up being poor benefits.

- Amartya Sen (1992)

1. Introduction

India's Public Distribution System (PDS) is perhaps the largest food safety net program in the world, accounting for over 1 percent of India's GDP, and growing in size (Kumar et al. 2017). For families below the poverty line, the implicit subsidies from PDS can be large – in many states equivalent to a week of NREGA wages every month (Khera 2011). Families above the poverty line were historically excluded from this targeted program, but increasingly, Indian states are widening the criteria for PDS inclusion. Average PDS purchases of wheat and rice doubled between 2004/5 and 2009/10 (Drèze and Khera, 2011), for instance, partly with improved efficiency but also with expanded entitlements. In 2013, India's congress passed the National Food Security Act, moving the PDS and other food safety nets from an entitlements-based approach to a right-based approach. This Act expanded PDS coverage further especially in rural areas, but stopped short of the universalization that many called for. During the Covid-19 pandemic, it became evident that ~100 million Indians who should have qualified for entitlements were still excluded from the PDS by their inability to procure ration cards (Khera and Somanchi, 2020); this fact drew national outcry after a 5-year-old girl in such a family starved to death during a Covid lock-down.[1][2]

[1] This inability stemmed partly from the government fixing ration card supply according to outdated population estimates. Particular sub-populations like migrant laborers facing separate constraints to accessing entitlements.

[2] https://www.aljazeera.com/news/2021/9/6/india-poor-ration-card-food-grains-pds-poverty
https://thewire.in/rights/covid-19-100-million-hunger-pds-universal

So, the question of who should be included and excluded from India's PDS program is topical, and likely important for policy outcomes. In this paper, we ask whether universalizing the PDS in the Indian State of Odisha improved access to PDS entitlements and ultimately women's health. To do so, we use a natural experiment. In 2008, the Odisha government simultaneously increased PDS entitlements and universalized access to the PDS (i.e., provided equal entitelments to households above and below the poverty line) in the particularly poor Kalahandi-Balangir-Koraput (KBK) region. In the rest of the state, the government increased PDS entitlements for poor households in an equivalent manner, but did *not* universalize PDS. We find that while universalization had little effect on women's health (BMI) in above poverty line households, it improved health in below poverty line households. We also see that the women who were underweight in our baseline data were particularly, positively impacted by universalization. These (early) results suggest that universalization in the KBK region of Odisha improved access to entitlements and therefore human welfare in the poorest families, as in fact policymakers intended it to do.

Our paper is the second that we know of to examine the causal impact of PDS universalization on nutrition outcomes. It is also the first paper that we know of to examine the impact of the PDS on a direct measure of health. Rahman (2016) exploits the same natural experiment that we use in Odisha to examine the impact of universalization on food and nutrient consumption. He finds that indeed, universalization increases calorie, protein, and fat intake from a variety of cereal and non-cereal sources. However, his paper cannot speak to *which* households were impacted by the reform,

and he does not examine health directly.[3] Previous studies have used state level variation in APL allotments per households (Kochar 2005) or variation in subsidy, coverage levels, and PDS governance (Krishnamurthy et al. 2014, Kishore and Chakrabarti 2015; Kumar et al. 2017; Khera 2011) to study the impacts of a more inclusive PDS (rather than a fully universal one). The findings suggest that a more inclusive PDS had a positive impact on poor household's program participation and improved their diet and calorie intake.

Our findings contribute to literature on the targeting of social safety nets. In poor countries, social safety net beneficiaries are often selected through a "proxy means test" (PMT): the government collects information on household assets and demographic characteristics (the "means" through which households achieve income and consumption), creates an index based on that information (in theory "proxying" for the permanent component of income), and determines program eligibility based on an index cut-off. Precisely such a method was used for the PDS ration card status, and hence entitlement eligibility, in India. During the 2004-2012 period that we study, PDS ration card status was based on household data gathered in India's 2002 census.[4] The method defined 13 criteria (reflecting asset ownership, education, occupation, etc.), each with a score from 0-4, resulting in an aggregate index that varied from 0-52. Localities each defined an index cut-off for determining poverty status (Sundaram 2003). Unfortunately, the resulting ration card status was

[3] Rahman (2016) does attempt a triple difference estimation that would separate impact for above poverty line and below poverty line households. However, it does not account for the pre existing differences in PDS subsidy that existed across different spatial regions of Odisha before the 2008 reform.

[4] In fact, because some households during 2004/2005 had not yet received 2002 census ration cards, they were using ration cards based on the 1997 census (Khere and Dreze 2010). Khera (2008) argues that this first proxy means test was even more faulty than the subsequent one, with faulty criteria and a uniform cut-off across India.

not well aligned with either per capita expenditure or wealth index in nationally representative data from 2004 (Drèze and Khera 2010).

This may not be surprising; determination of poverty by a PMT is obviously imperfect. It suffers from faults in the original survey, measurement error in the collected data, and from the inconvenient fact that poverty status varies over time. A long list of authors have suggested that community-based targeting might leverage local information to out-perform PMT targeting, though two recent experiments find that it yields little improvement when it comes to predicting consumption (Alatas et al. 2012, Karlan & Thuysbaert 2019). Henderson and Follett (2022) alternatively propose that targeting on observable welfare "ends" (e.g. food security, health) is superior to targeting on the "means" of creating welfare (assets, education), and further that ideally one should target on the capacity to achieve those ends rather than the ends themselves.[5] Yet such capability targeting has never been tested experimentally, and is likely to prove challenging. Haushofer et al. (2022) point out that targeting on any measure of welfare may be inefficient if the poorest households have lower than average treatment effects – targeting on a combination of poverty and predicted treatment effect would then be optimal. Yet predicting treatment effect is also likely to prove challenging. Also, if the goal is to reduce poverty, policymakers should logically alter the program itself rather than the targeting of it, if they realize that treatment effects are low for the poorest households.

So while the search continues for improved forms of targeting, we compare the effects of traditional PMT targeting – in a context where it is known to be highly imperfect – to the effect of no targeting at all. We hypothesize that universalizing the PDS in Odisha might reduce exclusion

[5] Here they are following closely on Sen (1992). The importance of capacity is easily illustrated by comparing a family that is starving to a family that is fasting.

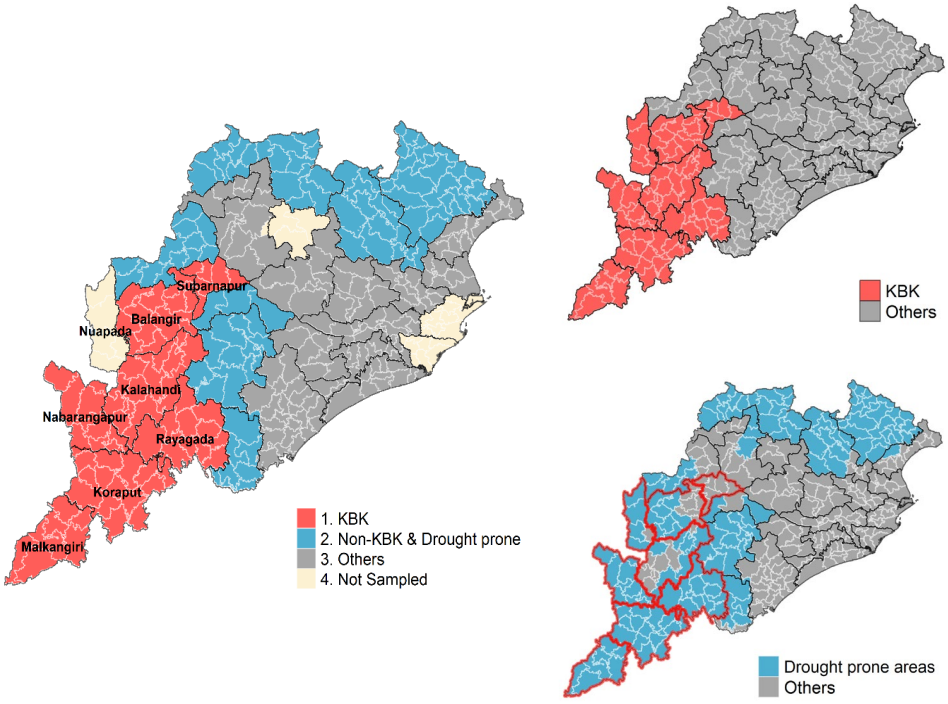
errors (by providing entitlements to poor families who are not deemed poor by their ration card status), and could additionally improve the quality of benefits for all families, since "benefits meant exclusively for the poor often ends up being poor benefits" (Sen 1992).

2. Background: PDS in Odisha and the 2008 reforms

Before the introduction of National Food Security Act (passed in 2013) and for the period relevant for our study, state governments, including Odisha, followed the targeted Public Distribution System (PDS), which recognized Above-Poverty-Line, Below-Poverty-Line, and Annapurna rations cards. These ration cards are documents issued by the state government to households that meet certain eligibility criteria and allows these households to purchase subsidized foodgrains (including wheat, rice, sugar, and kerosene) under PDS. However, the monthly quantity of each foodgrain that a household is entitled to purchase at a subsidized rate (determined by government) depends on the type of ration card held by the household. In Odisha, prior to 2008, the situation was more complex. Odisha government followed a system of both card based and geographic targeting wherein eligible households could purchase 25 kgs of rice per month but the subsidy provided to households varied not only by ration card status but also spatially by the region of residence.

Figure 1 illustrates the location of the three key geographic areas in Odisha that determined the PDS entitlements for rice: Kalahandi-Balangir-Koraput (KBK) districts, non-KBK districts holding drought-prone blocks, and non-KBK districts without drought-prone blocks.[6,7,8] The first spatial variation was in the price entitlements of PDS rice for below poverty line households. While

Figure 1: Odisha District Groupings Relevant to the 2008 Price Reform Policies



Note: In the figure on the right, top panel, the region in red represent the Kalahandi-Balangir -Koraput region (KBK) which comprises of 8 districts where PDS was universalized and the PDS subsidy for rice was increased. In the figure on the right, bottom panel, the regions in blue represent the drought prone areas that are given special central assistance under the nationwide Drought Prone Area Program (DPAP). The figure on the left presents the final classification used in our analysis, where all KBK districts are in red, all drought prone but non-KBK regions are shown in blue, and all the other regions are in gray. The regions not present in our sample are shown in yellow.

[6] The administrative structure of India comprises of 28 states. Each state is subdivided into districts. Odisha consists of 30 districts which have been further subdivided into 314 blocks.

[7] The Kalahandi-Balangir-Koraput region (KBK) is comprised of 8 districts (80 blocks) in south-west Odisha. This resource rich, tribal dominated region was identified in the 1990s as one of the poorest regions of the country. As a result, both center and state governments have adopted a special area development approach and implemented various kinds of schemes in these districts to accelerate its development (Planning commission, 2002).

[8] The Drought prone blocks includes 118 Integrated Tribal Development Project (ITDP) blocks and 47 blocks from eight districts that are recognized under the nationwide Drought Prone Area Program (DPAP). The ITDP regions have a scheduled tribe population of more than 50% and receive special central assistance under the tribal sub plan for the welfare of the tribal communities (Bhuria, 2004; Ministry of Tribal Affairs, 2016) whereas the DPAP program was launched by the central government since 1973-74 to tackle special problems faced by drought affected regions across India (Ministry of Rural Development, 1994).

all families having a below poverty line ration card were entitled to receive 25 kgs of subsidized PDS rice monthly, those living in non-KBK, non-drought-prone districts could buy the entire 25 kgs at 6.3 Rs/kg, whereas poor families living in KBK districts or drought-prone blocks were entitled to buy 16 kgs of rice at 4.75 Rs/kg and the remaining 9 kgs of rice at 6.30 Rs/kg. Thus, the effective price was 5.3 Rs/kg for below poverty line households in the KBK and drought prone blocks as opposed to 6.3Rs/kg in the non KBK, non-drought prone regions. The second variation existed across KBK and non-KBK districts among the above poverty line households. Unlike the rest of Odisha, in KBK districts, even families designated as "above poverty line" were entitled to 25 kgs of subsidized rice per month at a price of 6.3 Rs/kg.

The 2008 reform was made of up two components. First, across Odisha, the price of PDS rice was dropped to 2 Rs/kg for families below poverty line. In both KBK districts and non-KBK, drought-prone blocks, this amounted to two changes, vis-à-vis the pre-reform scenario: (i) a reduction in price (from an effective 5.3 Rs/kg to 2 Rs/kg) and (ii) a simplification of the pricing system (a single price for all 25 kg rather than one price for the first 16 kg, another for the second 9 kg). In the rest of Odisha, only a reduction in price was experienced, with no simplification, and was only slightly larger than the reduction in the KBK districts and non-KBK drought-prone blocks (a 68 vs. 62 percent reduction). Second, in the KBK districts alone, "uniform universalization" was implemented.[9] That is, above poverty line families who had previously experienced very little subsidy for rice (a PDS price of 6.3 Rs/kg, when the market price was 8.5 Rs/kg) were now entitled to the same price as were below poverty line families: 2 Rs/kg (Bedamatta 2016).

[9] In a uniform universal PDS, no distinction exists in the price and quantity entitlements of above and below poverty line ration card holders (Dhanaraj and Gade 2012). Prior to 2008, in the KBK districts, Odisha government had a differentiated universal PDS system in place in the KBK districts offering same quantity entitlements but different price subsidies on PDS rice to different card holders.

Table 1: Effective subsidy, before and after the 2008 price reform (in Rs/25 kgs)

	Above poverty line			Below poverty line		
	KBK	Non-KBK & drought-prone	Other	KBK	Non-KBK & drought-prone	Other
2004-05	49.75	0.00	0.00	70.55	79.80	53.75
2011-12	211.10	0.00	0.00	198.58	218.79	206.83
Effective Subsidy Change (Rs)	161.35	-	-	128.03	138.99	153.08
Effective Subsidy Change (%)	324%			181%	174%	285%
Policy Changes	Universal	-	-	Universal & Simple	Simple	-

Notes: Effective subsidy has been reported at 2004-05 constant prices. It is calculated by multiplying the difference between the subsidized price and the average market price for rice reported by IHDS respondents with the total 25 kgs entitlement to which a beneficiary is eligible under PDS.

Table 1 shows changes in total effective subsidy per month before and after 2008, for each type of ration card holder and across each region. It is worth stating clearly what impacts might be expected where, from each component of this reform. First, if the *reduction in price entitlement* improved welfare, we would expect to see that improvement for all below povery line families in Odisha. However, since the increase in effective subsidy for below poverty line families in the non-KBK, non-drought-prone (or "other") regions of Odisha was only slightly greater than the KBK districts, we do not expect to see much differences in impact across regions. Moreover, if we believe that the initial 2-tier price system for below poverty line families in KBK districts and drought-prone blocks was hampering these families from receiving their full entitlement, they may have been paying something closer to 6.2 Rs/kg to begin with, making the joint impact of price reduction and price simplification even more similar across the various regions of Odisha. In

contrast, we expect the welfare gains from reduction in price entitlement to be limited to the above poverty line families in KBK districts, for whom the effective subsidy increased 324%.

Second, if the *elimination of targeting* in KBK indeed improved the overall functioning of the PDS system, we should see a greater improvement for below poverty line families in KBK than we see for below poverty line families in the rest of Odisha. Advocates of universalization suggest that inclusion of relatively better off sections of society can also contribute to greater accountability.[10] If doing away with targeting and increased participation by above poverty line households in KBK improved the state's ability to reach the most vulnerable families, then we should also see a greater improvement for the poorest and most malnourished families, regardless of card status, in KBK than in the rest of Odisha.

3. Data and Descriptive Statistics

For our main analysis, we use two rounds of Indian Human Development Surveys (IHDS-1 and IHDS-2) conducted in 2004-05 and 2011-12, which had two main modules: a household questionnaire and a women's questionnaire (Desai et al., 2007; Desai et al., 2015). The household questionnaire gathered socio-economic information on household income, employment, food consumption, spending, and asset ownership, from a knowledgeable member, usually the household head. The women's questionnaire collected data on health, education, marriage, and gender relations within the household and the community from an ever-married women who was at least 15 years old. To validate our pre trend results, we also use data from the National Family Health Survey 2015-2016 (NFHS-4).

[10] Justice Wadhwa committee report (2009) mentions that the number of beneficiaries increased from 30 to 55 lakh following the 2008 subsidy expansion.

For analysis, we restrict our sample to approximately 1250 adult women from Odisha, who were at least 20 years old at the time of survey and were interviewed in both the rounds. We use the anthropometric data (women's height and weight) to calculate Body Mass Index (BMI), which is our main outcome variable and a commonly used measure of women's nutrition. Residential information is used to construct region dummies for our three key geographic areas: KBK, Non-KBK drought prone areas and the other remaining regions. KBK region dummy includes all 8 districts that have the KBK status irrespective of coverage levels under the ITDP-DPAP program. However, unlike KBK, drought prone area status is assigned at the block level which is not identified in our data due to confidentiality reasons. We therefore use district-wise coverage (percentage of blocks in a district that were assigned ITDP-DPAP status) to distinguish between non-KBK Drought-prone and other regions. Non-KBK Drought-prone region includes 7 districts that are not KBK but have 50% or more blocks covered under ITDP-DPAP program. The remaining 15 not KBK districts that have less than 50% coverage under ITDP-DPAP are classified in the Other category. Detailed information on district-wise coverage under ITDP-DPAP program is provided in **Table A1**.

Table 2 presents summary statistics for all individual and household covariates considered in our analysis. These descriptive statistics reveal that while women's average Body Mass Index (BMI), our primary outcome variable, was lowest in the KBK region (at 19.24 kg/m^2) in the first round, it became the highest among the three regions (at 21.46 kg/m^2) in the second IHDS round. Even the proportion of underweight women which was at 43% in KBK in the first round saw maximum decline and reduced to 17% in the second round. Moreover, as shown in **Figure 2**, substantial increases in quantity of rice purchased through PDS was observed between 2004-05 and 2011-12, with the most pronounced increase seen in the KBK region. The proportion of people who reported purchasing PDS rice (in last 30 days) increased from 23% in 2004-05 to 85% in 2011-12 and the

quantity of PDS rice purchased (in last 30 days) increased by 20.6 kgs during the same time period. While only descriptive, these statistics not only suggest effective implementation of the reform but provides rationale for further investigating the distributional impacts of this reform.

4. Empirical Strategy

In the absence of yearly measures of women's BMI leading up to the 2008 policy change, we test if pre-trends in women's height (a measure highly correlated with BMI) varies across KBK, non-KBK drought prone, and other remaining regions. We specifically focus on women born between 1949 and 1989 who were interviewed in IHDS round 2. These women were at least 20 years old at the time of policy reform and it is unlikely that they would have experienced improvement in their heights on account of policy change. Moreover, since adult height is crucially linked with nutrition in early childhood and is often used as a measure of cumulative net nutrition (Perkins et al. 2016), it serves as a good candidate to test if changes in nutrition environments differed spatially before 2008.[11]

$$Height_{ijt} = \alpha + \beta_1 BirthYr_t + \beta_2 KBK_j * BirthYr_t + \beta_3 DP_j * BirthYr_t + \beta_4 KBK_j + \beta_5 DP_j + \epsilon_{ijt} \quad (1)$$

We estimate the above equation separately for women above and below the poverty line. Here height of i^{th} women residing in j^{th} district born in year t ($Height_{ijt}$) is the outcome variable and KBK_j and DP_j are KBK and drought prone region dummies. $\beta_2, \beta_3 -$ coefficients of the interaction terms are of main interest where a statistically significant coefficient would suggest non-parallel

[11] Examining pre-trends in "cumulative health" of women born prior to 1989 provides us with intuition regarding the *long-run* pre-trends in women's health across regions. However, it fails to provide us with region-specific *short-run* trends in women's health across regions. Which is why future drafts we will also look at child's birthweight for infants born just before 2008, as an alternative measure to determine if pre trends hold in the short run.

pre-trends. As part of robustness check, we repeat this exercise using NFHS-4 data, collected in 2015-16, that allows us to work with a much larger sample.

To examine the impacts of the policy reform on women's BMI, we use a differences-in-differences methodology. We expect the reform to impact above and below ration card groups differently due to pre-existing differences in their price entitlements before 2008. As a result, we estimate equation (2) separately for the two ration card groups where the type of card reportedly held at baseline (IHDS round 1) is used to classify a household as an above or below poverty line household. The use of baseline card status is done to control for self-selection bias which could occur if relatively well-off households (both nutritionally and otherwise) in KBK, who did not have a ration card in 2004, illegally obtained one post policy change to take advantage of the subsidy benefits.

$$BMI_{ijmt} = \alpha + \beta_1 KBK_j * post_t + \beta_2 DP_j * post_t + X_{ijt} + \Upsilon_{mt} + \theta_j + \epsilon_{ijt} \qquad (2)$$

In the above equation BMI_{ijmt} is the BMI of i^{th} women in month *m* of year *t* residing in j^{th} district. Our explanatory variables include interaction between post-policy time dummy ($post_t$) and KBK region dummy (KBK_j) and interaction between $post_t$ and non-KBK drought prone region dummy (DP_j). To estimate the causal impact, we also control for individual and household characteristics (X_{ijt}), month-year fixed effects (Υ_{mt}) to control for seasonality in women's anthropometry data, and district fixed effects (θ_j). The main coefficient of interest is the difference-in-differences coefficient - β_1, β_2 . If parallel trends hold, these coefficient measures the effect of the 2008 policy change on BMI for women residing in the KBK and non-KBK drought-prone districts, respectively relative to the omitted region. In this specification the omitted region are all the districts that are neither KBK and nor drought prone.

The X_{ijt} considered in our analysis includes women's age, age squared, years of schooling, number of kids ever born, age at first union (in years), and indicator variables for: pregnancy at the time of

survey, caste (scheduled caste, scheduled tribe, other backward caste, and general) and religion (Hindu, and others) of the houshehold head, rural residence, and access to improved drinking water and toilet. We include month-year dummies to control for seasonality in women's anthropometry data. Differences in month wise data collection across the two survey rounds makes their inclusion important since more data in round 2 (2011-12) was collected during months when women's BMI was relatively low **(Figure 5)**.

We also estimate equation 1 and 2 separately for women subgroups who were underweight, normal weight and overweight at baseline (2004-05), irrespective of their ration card holding status. This is to ascertain if the improvements in BMI was led by women with poor nutrition status. Given Odisha government's poor track record in targeting right beneficiaries under PDS, it is possible for improvements in BMI to be led by women who are in the upper end of BMI distribution rather than the lower end. WHO recommends five categories to assess an individual's weight status based on one's BMI. Due to sample considerations, we only consider three weight ranges - underweight category which includes women with BMI less than 18.5 kg/m^2, normal weight which includes women with BMI greater or equal to 18.5 kg/m^2 but less than 25.0 kg/m^2, and overweight includes women with BMI greater than or equal to 25.0 kg/m^2.

Lastly, we also estimate equation 1 and 2 separately for women subgroups who were underweight, normal weight and overweight at baseline (2004-05), irrespective of their ration card holding status. This is to ascertain if the improvements in BMI was led by women with poor nutrition status. Given Odisha government's poor track record in targeting right beneficiaries under PDS, it is possible for improvements in BMI to be led by women who are in the upper end of BMI distribution rather than the lower end. **Figure 6** shows the BMI distribution for both above and below poverty line. Here we can see that for both the ration card categories, a not so insignificant

proportion of the distribution falls close to or above the the overweight cut off. Therefore it is important to determine the true beneficiaries of the PDS reform. We use the following three WHO recommended BMI ranges used to assess nutritional status: underweight category which includes women with BMI less than 18.5 kg/m^2, normal weight which includes women with BMI greater or equal to 18.5 kg/m^2 but less than 25.0 kg/m^2, and overweight which includes women with BMI greater than or equal to 25.0 kg/m^2.[12]

5. Results

5.1. Testing Pre trends

Figure 7 using IHDS-2 (2011-12) shows trends in height of women belonging to below and above poverty households at baseline. The corresponding regressions results are provided in **Table 3.** For the two ration card groups the pre trends appear parallel. Moreover, the interaction of region dummies with year of birth is statistically insignificant for both above and below poverty line women, except for non-KBK drought prone region. For the latter group, the interaction term is statistically significant at 10% and negative. This points to a diverging trend suggesting that a statistically significant difference-in-differences causal estimate for this group will in fact be a conservative estimate of the true treatment impact.

As robustness check, we also examine pre trends using the NFHS-4 data since it has a much larger sample size. **Figure 8,** constructed using NFHS-4 data, shows pre trends for women who have below poverty line ration card and those that do not (including non-card holders). This difference

[12] According to WHO 2006 guidelines, BMI can be used to determine which of the five health weight classification one falls in - Moderate and severe thinness (BMI < 17.0 kg/m^2), Underweight (BMI ≥ 17.0 kg/m^2 and < 18.5 kg/m^2), Normal weight (BMI ≥ 18.5 kg/m^2 and < 25.0 kg/m^2), Overweight (BMI ≥ 25.0 kg/m^2 and < 30.0 kg/m^2) and Obesity (BMI ≥ 30.0 kg/m^2).

from IHDS arises because NFHS-4 survey only asked respondents if they had a below poverty line card and did not ask about the type of ration card held. The corresponding pre-trend regression results are presented in **Table 4**. Although the interaction terms are statistically insignificant, the graph for below poverty line women (left panel) indicates an upward trend in height for younger women in the reference districts, while it shows a decline in KBK regions. However, again the observed divergence in trends here implies that any causal impact of the reform on below poverty line KBK women will be a conservative estimate.

Similarly, **Figure 9 and 10** show pre trends in height of underweight and not underweight women constructed using IHDS and NFHS data respectively. The corresponding regression results are given in **Table 5 and 6** respectively. The pre trends appear parallel and is supported by statistically insignificant interaction of KBK and non KBK drought prone region dummies and birth year variable.

5.2 Main Results

A) By Baseline Ration Card holding

Table 7 presents the difference-in-differences regression estimates for baseline above poverty line women. While women's BMI show a general improvement over time, we do not find evidence that BMI of above poverty line women in KBK improved more than those living in other districts post 2008 (Column 1). This is surprising since above poverty line households saw the maximum increase in rice subsidy with 2008 reform. The difference-in-differences coefficient for non-KBK drought prone districts is also statistically insignificant. This however was expected as the expansion of PDS rice subsidy to above poverty line households was limited to the KBK districts only. To test the robustness of our results to outlier values, we estimate the result for winsorized BMI (top one percentile of the BMI distribution replaced with the 99th percentile value) and

trimmed BMI (top one percent observations dropped) sample. The results, given in **Table 7**, columns 2 and 3, remain mostly unchanged.

One possible explanation for the null result in KBK districts could be the movement of baseline above poverty line card holders to other ration card groups. Of 324 baseline above poverty line card holders, 25% reportedly held no ration card in 2011. Our sample therefore includes women whose card status changed either before or immediately after 2008, and who possibly experienced little to no subsidy benefit under the reform. Restricting our sample to women who held above poverty line ration card in both IHDS round 1 and round 2 results in a 1.79 kg/m^2 greater increase in BMI in KBK relative to other districts (Column 2, **Table 8**).

Table 9 presents the difference-in-differences regression estimates for baseline below poverty line women. We find strong positive impacts of the reform on women's BMI in the KBK region. BMI of baseline below poverty women in KBK districts increased by 1.636 kg/m^2 more than those living in the reference districts after 2008 (Column 1). This result is strongly significant at 1% level and is robust even when we winsorize or trim the BMI outcome (Column 2 and 3) or restrict the sample to women holding below poverty line ration card in both the rounds **(Table 10)**. However, we do not see any improvement in women's BMI in non-KBK drought prone districts compared to other region as a result of the reform.

B) By Baseline BMI Category

Table 11 presents separate causal estimates for women who were underweight, and normal or overweight at baseline (Column 1 and 2 respectively). For baseline underweight women, BMI in KBK increased 1.5028 kg/m^2 more than the reference districts post 2008. No such impact is seen for women who were normal or overweight in round 1. This holds even when we winsorize or trim the BMI outcome for normal and overweight women as shown in **Table 12**. We also do not see

any changes in women's BMI in the non KBK drought prone districts as a result of the reform. Overall, these results are consistent with the results discussed above for different ration card groups, and suggest that the BMI improvements among baseline below poverty line women in KBK districts due to the 2008 reform are led by women who were also underweight at baseline.

C) Mechanisms

We next examine household level changes in food consumption, spending on medical, education and other items, and total asset ownership between the two rounds and across ration card groups to identify the channels that explain reform led BMI improvements in KBK districts among baseline below poverty line women.

We first discuss the results for baseline above poverty line households residing in KBK districts. **Table 13** presents causal estimates for PDS rice and total rice consumption. We see that households in KBK districts, compared to other regions, saw a 35.39 percentage points greater increase in the likelihood of purchasing PDS rice and 1.391 greater increase in Inverse Hyperbolic Sine (IHS) of kgs of PDS rice purchased.[13] However, this increase in PDS rice is not accompanied with an increase in median rice consumption or rice expenditure as shown in Column 3 and 4. This suggests only a shift in rice purchase location and not rice consumption patterns and was likely done by above poverty line households to take advantage of expansion in subsidy benefits.

We however expected the consumption of other food items to increase due to subsidy savings from PDS rice purchase. We find no such increase in purchase of other PDS items such as wheat and

[13] Mckenzie (2023) points out that coefficients of IHS outcomes are highly sensitive to the units that the outcomes is measured in (Eg dollars vs thounsands of dollars) and therefore should not be interpreted in percentage terms, as is the current approach. Instead one should interpret the coefficient as the treatment impact on the inverse hyperbolic sine of the outcome variable.

sugar **(Table 15)**. Among other food items, only the likelihood of consuming other cereals (in the last 30 days) increased 19.66 percentage points more in KBK post 2008 **(Table 17, column 1)**, and overall IHS kgs of sugar consumed increased 0.4484 more in KBK **(Table 18, column 1)**. The lack of impact of the reform on the consumption patterns of above poverty line houseolds explains why we do not see any improvements in women's BMI in KBK districts (versus the others) post 2008.

Moving to the baseline below poverty line women in KBK districts, we expected improvements in PDS purchases and/or improvements in overall food consumptions patterns which could explain increases in women's BMI in KBK post 2008. **Table 14** shows that PDS rice purchase did not change either at the intensive or the extensive margin. However, we do see a 6.68 kgs higher increase in median rice consumption among baseline below poverty line households in KBK post 2008. Besides rice there is a 16.13 percentage points higher likelihood of purchasing PDS sugar and 0.2608 more IHS kgs PDS sugar being purchased in KBK **(Table 16)**. This increase in PDS sugar is not accompanied with increase in total sugar consumption **(Table 18, Column 3)**. As shown in **Table 18, column 1**, only IHS consumption of other cereals (which includes bread, muri, chira, maida, suji, and noodles) has seen a higher increase among below poverty card holders in KBK. Surprisingly, consumption of several other food items like pulses, milk, milk products, processed foods, fruit and nuts, and vegetables has seen a decline either on the extensive margin, inensive margin or both. These consumption patterns stand in contrast to BMI improvements seen among this group.

Next we also explore changes in household medical, education, and other expenditures and overall asset ownership to determine if a differential improvement in wealth indicators across regions and card holding groups could explain our results (**Column 3 of Table 19 and table 20**). Again, we

find no changes in the total spending of baseline below poverty line households in KBK in the last 365 days on school/college fees, private tuition and schoolbooks, personal transport equipment and insurance premiums. Rather, the household spending on medical care, and jewelry (often an investment source in Indian households) has shown a greater decline post 2008. These households were also 13.5% less likely to own/cultivate agricultural land, and 38.8% less likely to own any livestock, and experienced a differentially greater decline in livestock ownership relative to other districts. All of this seems to suggest that the general welfare of below poverty line households has declined over the two rounds more so in KBK compared to other districts which stands in contrast to the improvements in the women's BMI.

For baseline below poverty line women, we expected the elimination of price targeting (and improved PDS functioning) to be the primary channel through which this group saw an improvement in nutrition outcomes. However, lack of any changes in PDS purchases and general decline in consumption of nutritional food items (except for rice and other cereal consumption) and wealth indicators, fails to explain why we are seeing BMI improvements for this group post 2008 reform. The results need to be investigated further.

6. Conclusion

We exploit a 2008 natural experiment conducted in Odisha, India, to study the impact of universalization on women's nutrition. We use the difference-in-differences approach to examine the heterogeneous impact of the reform on different ration card holding groups and different spatial groups. While we find no evidence of improvement in women's BMI for above poverty line women residing in KBK districts relative to other regions, we do find strong evidence of a positive improvement of women's BMI for below poverty line women residing in KBK districts.

Surprisingly, the improvement in nutrition outcomes is not supported by improvements in consumption of various food items. Future analysis will focus on unearthing the reasons behind the strong nutrition impacts seen in KBK districts

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Table A1: Districtwise details on blocks where Below-Poverty-Line card holders were provided PDS rice at dual prices before 2008

Treatment Regions	Total Blocks	# blocks having dual pricing	Coverage Intensity (% blocks with dual pricing)	In full sample? (Y/N)	In restricted sample? (Y/N)
		KBK Districts			
Balangir (Bolangir)	14	8	>= 50%	Y	N
Kalahandi	13	6	< 50%	Y	N
Koraput	14	14	Full	Y	Y
Malkangiri	7	7	Full	Y	Y
Nabarangpur	10	10	Full	Y	Y
Nuapada	5	4	>= 50%	N/A	N/A
Rayagada	11	11	Full	Y	Y
Subarnapur (Sonepur)	6	0	None	Y	N
		Non-KBK Drought Prone Districts			
Bargarh	12	6	>= 50%	Y	N
Baudh	3	2	>= 50%	Y	N
Gajapati	7	5	>=50%	Y	N
Kandhamal	12	12	Full	Y	Y
Kendujhar	13	10	>= 50%	Y	N
Mayurbhanj	26	26	Full	Y	Y
Sundargarh	17	17	Full	Y	Y
		Other Districts			
Angul	8	0	None	Y	Y
Balasore (Baleshwar)	12	1	< 50%	Y	N
Bhadrak	7	0	None	Y	Y
Cuttack	14	0	None	Y	Y
Debagarh (Deogarh)	3	0	None	N/A	N/A

Dhenkanal	8	0	None	Y	Y
Ganjam	22	0	None	Y	Y
Jharsuguda	5	0	None	Y	Y
Jajpur	10	0	None	Y	Y
Jagatsinghapur	8	0	None	N/A	N/A
Kendrapara	9	0	None	N/A	N/A
Khordha (Khurda)	10	0	None	Y	Y
Nayagarh	8	0	None	Y	Y
Puri	11	0	None	Y	Y
Sambalpur	9	3	< 50%	Y	N
Total	314	142			

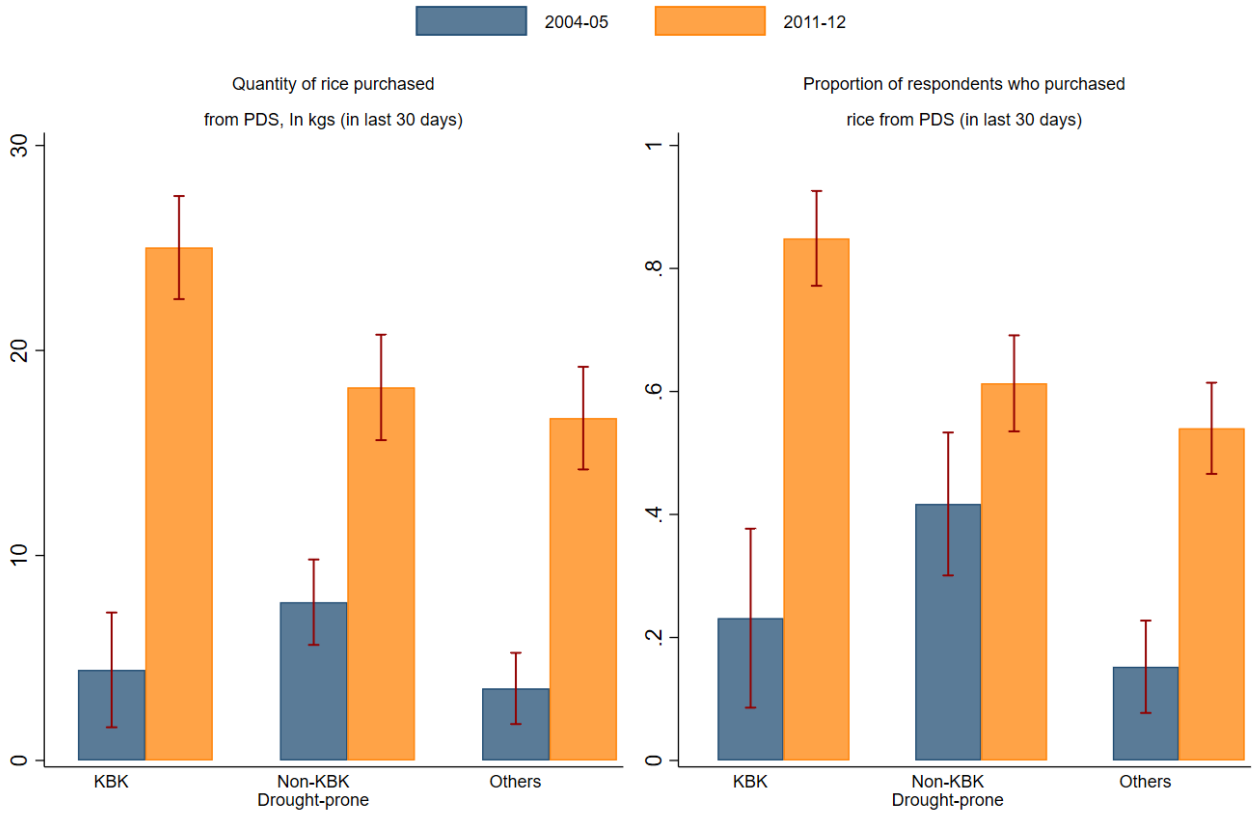
Note: Districts marked as N/A indicate regions that were not sampled in the IHDS and therefore could not be included in the analysis.

Table 2: Descriptive statistics for covariates included in our analysis

IHDS-1	KBK	Non-KBK Drought-prone	Others
BMI (kg/m²)	19.24	20.14	20.01
Underweight	0.43	0.30	0.34
Age (years)	33.27	33.88	34.42
Education (years)	1.68	2.68	3.54
Age at first union/gauna (years)	17.04	17.77	18.26
Number of kids ever born (#)	2.97	3.32	3.08
Currently pregnant (binary)	0.02	0.03	0.04
Household head is Scheduled Tribe (binary)	0.21	0.41	0.05
Household head is Scheduled Caste (binary)	0.23	0.18	0.26
Household head is Other backward Caste (binary)	0.48	0.36	0.59
Household head is Hindu (binary)	0.97	0.81	0.98
Rural residence (binary)	0.95	0.90	0.88
Improved source of drinking water (binary)	0.93	0.72	0.65
Improved toilet (binary)	0.02	0.06	0.08
N	170	284	551
IHDS-2	KBK	Non-KBK Drought-prone	Others
BMI (kg/m²)	21.46	20.50	21.29
Underweight	0.17	0.25	0.24
Age (years)	41.71	41.05	41.10
Education (years)	1.98	2.78	4.09
Age at first union/gauna (years)	17.13	17.43	18.32
Number of kids ever born (#)	3.48	3.72	3.41
Currently pregnant (binary)	0.03	0.01	0.00
Household head is Scheduled Tribe (binary)	0.21	0.42	0.05
Household head is Scheduled Caste (binary)	0.23	0.21	0.27
Household head is Other backward Caste (binary)	0.48	0.32	0.45
Household head is Hindu (binary)	0.94	0.89	0.98
Rural residence (binary)	0.94	0.84	0.81
Improved source of drinking water (binary)	0.95	0.82	0.75
Improved toilet (binary)	0.04	0.08	0.22
N	170	284	551

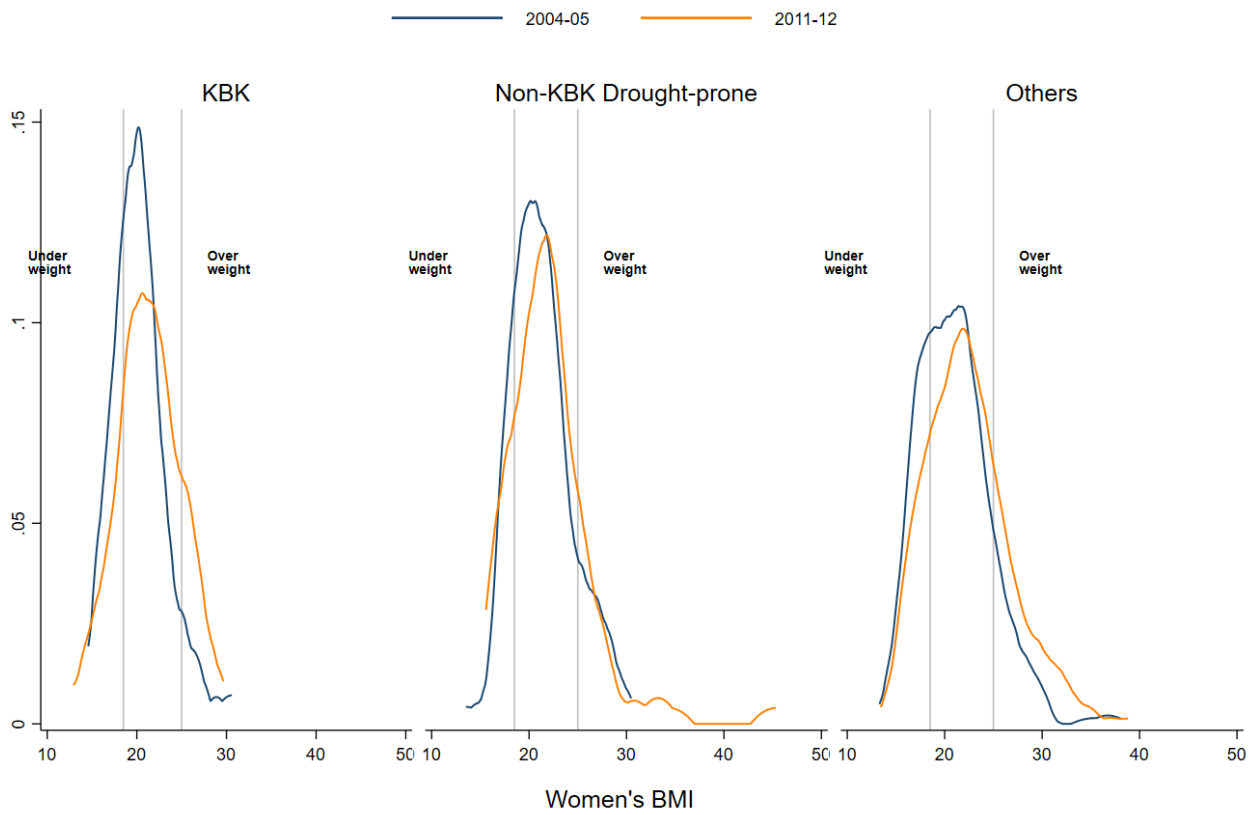
Notes: As per cut off provided by WHO, an adult women is considered underweight when her BMI is less than 18.5 kg/m2. Gauna is a custom largely observed in northern parts of India and is mainly associated with child marriages. While marriage rituals might be performed at a young age, the bride continues to live with her natal family till the Gauna ceremony is performed. It is only once Gauna is completed that the bride goes to live with her husband and conjugal relations begin. Question on the toilet facility was asked slightly different in IHDS 1 (2004-05). Instead of semi flush/septic tank latrine option, the questionnaire had ventilated improved pit latrine option.

Figure 2: Changes in PDS rice purchases, by survey round and region



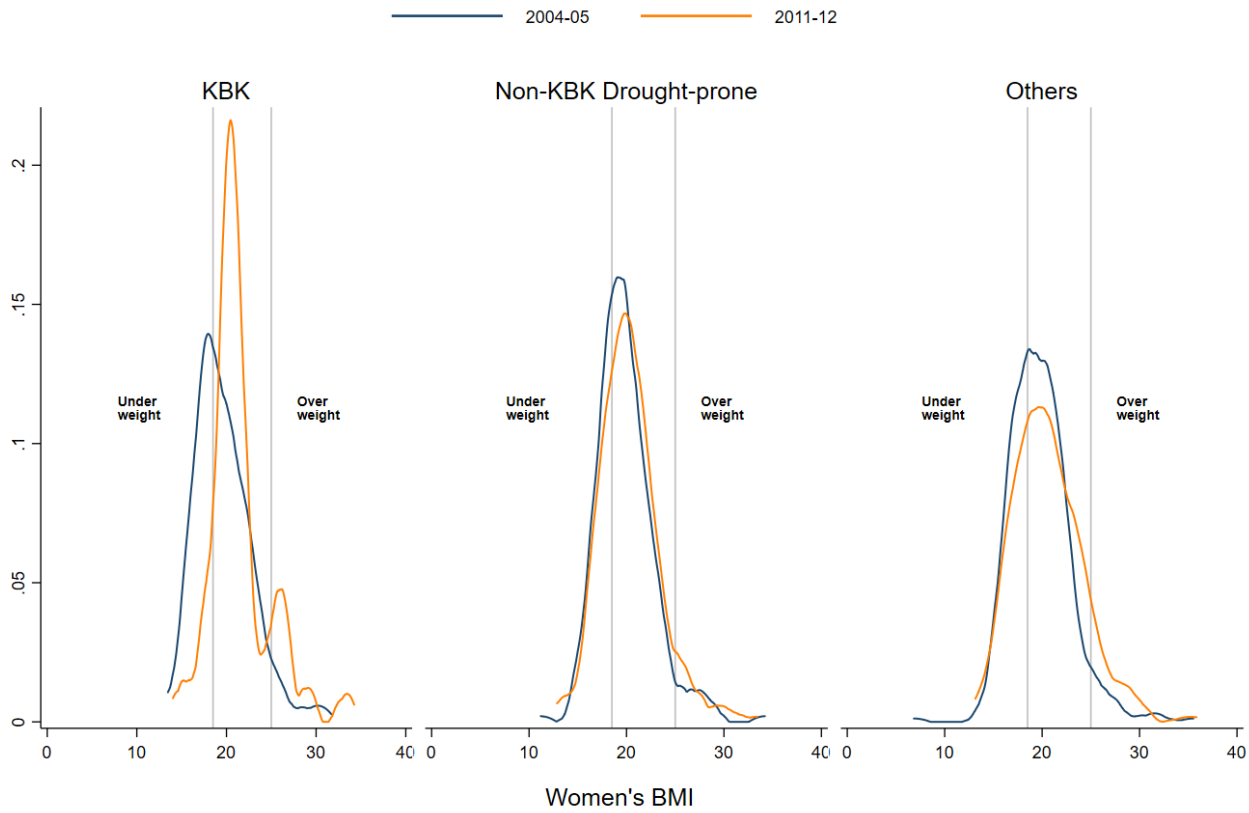
Note: IHDS survey asked respondent to report if the quantity of rice (in kgs) purchased from a PDS shop in the last 30 days. This variable was used to create both the binary and the continuous quantity variable.

Figure 3: Kernel density of BMI of baseline Above-Poverty-Line women by survey round and region



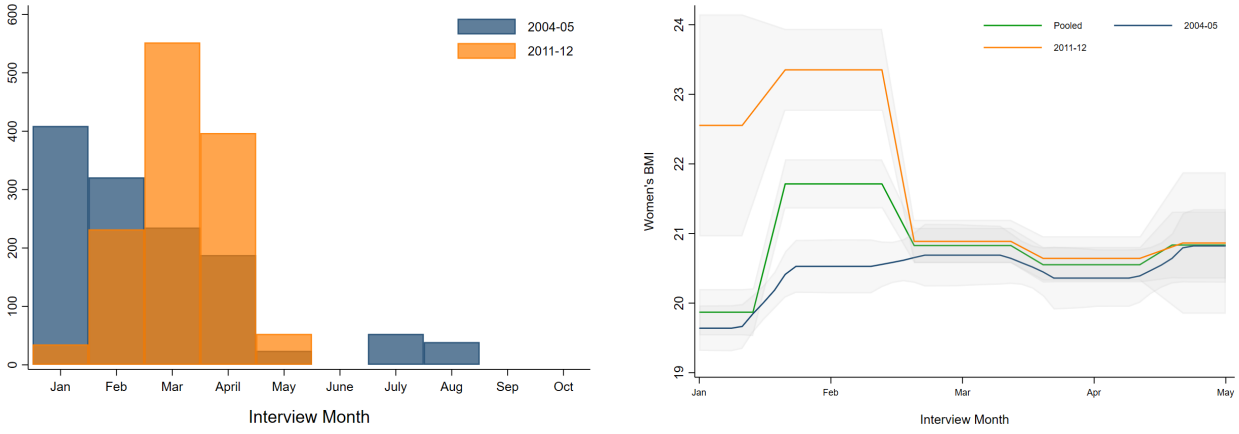
Note: The dashed grey lines mark the cuttoff points (18.5 kg/m^2 and 25.0 kg/m^2) used to classify women in three weight ranges. Underweight category includes women with BMI less than 18.5 kg/m^2, normal weight includes women with BMI greater or equal to 18.5 kg/m^2 but less than 25.0 kg/m^2, and overweight includes women with BMI greater than or equal to 25.0 kg/m^2.

Figure 4: Kernel density of BMI of baseline Below-Poverty-Line women by survey round and region



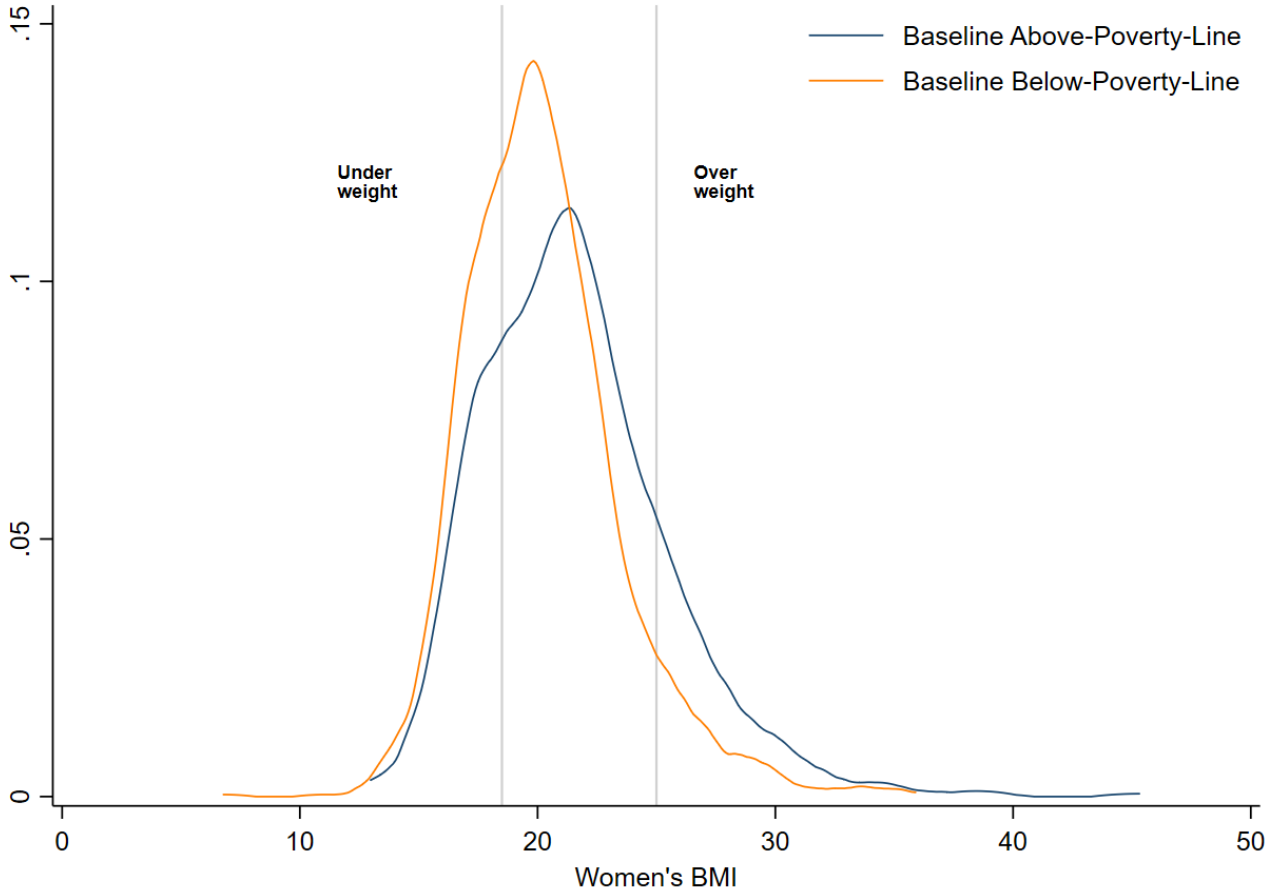
Note: The dashed grey lines mark the cuttoff points (18.5 kg/m^2 and 25.0 kg/m^2) used to classify women in three weight ranges. Underweight category includes women with BMI less than 18.5 kg/m^2, normal weight includes women with BMI greater or equal to 18.5 kg/m^2 but less than 25.0 kg/m^2, and overweight includes women with BMI greater than or equal to 25.0 kg/m^2.

Figure 5: Monthly Data collection by survey rounds



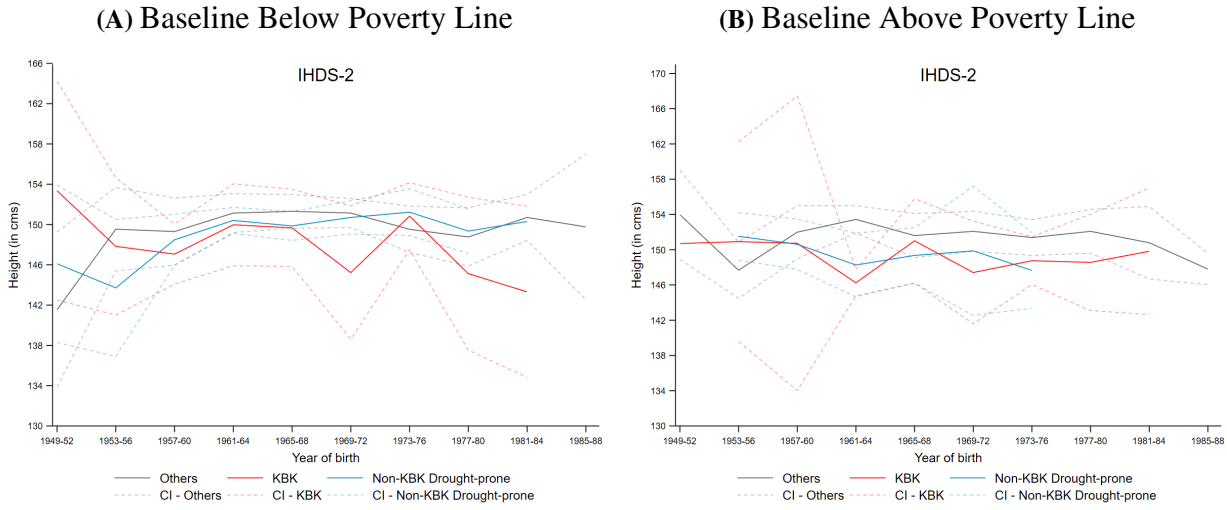
Note: The left panel shows the total number of interviews done each month and in each round. The right anel shows how ??.

Figure 6: Kernel density of BMI of baseline Above and Below-Poverty-Line women in survey round 1 (2004-05)



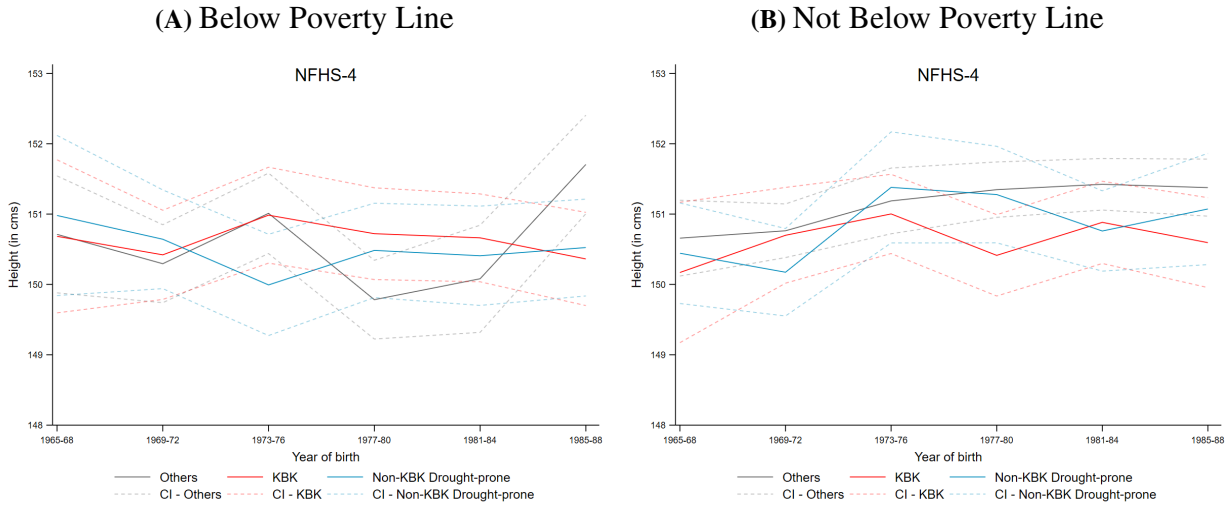
Note: The grey lines mark the cuttoff points (18.5 kg/m^2 and 25.0 kg/m^2) used to classify women in three weight ranges. Underweight category includes women with BMI less than 18.5 kg/m^2, normal weight includes women with BMI greater or equal to 18.5 kg/m^2 but less than 25.0 kg/m^2, and overweight includes women with BMI greater than or equal to 25.0 kg/m^2.

Figure 7: Pre trends in height of women born between 1949 and 1987, by baseline ration card (Using IHDS data)



Note: The figure shows trends in women's height as measured in IHDS-2 (2011-12). The left panel shows trends for women who held Below-Poverty-Line ration card at baseline (2004-05) and the right panel shows trends for women who held Above-Poverty-Line ration card at baseline (2004-05).

Figure 8: Pre trends in height of women born between 1966 and 1988, by ration card (Using NFHS data)



Note: The left panel shows trends in height of women belonging to households with Below-Poverty-Line ration card. Unlike IHDS-2, NFHS-4 only asked respondents if they they had a below poverty line ration card and id not collect data on the type of ration card held.The right panel therefore shows trends in heights of women who belong to Non-Below-Poverty-Line households as reported in NFHS-4 (2015-16) data.

Table 3: Pre-trends in height of women born between 1949 and 1987, by baseline ration card (Using IHDS data)

	(1) Height (cms)	(2) Height (cms)
KBK × Birth year	-0.1490	-0.0495
	(0.1259)	(0.1021)
Non-KBK Drought-prone × Birth year	0.1082	-0.1990*
	(0.0927)	(0.1072)
KBK	290.9359	94.9973
	(247.8096)	(201.1247)
Non-KBK Drought-prone	-213.7933	390.3680*
	(182.7696)	(210.7925)
Birth year	-0.0132	0.0163
	(0.0437)	(0.0624)
Constant	176.2859**	119.3320
	(86.0238)	(122.8918)
Observations	678	326
R sq.	0.047	0.043
Baseline Ration Card	Below-Poverty-Line	Above-Poverty-Line
Sample	Full	Full

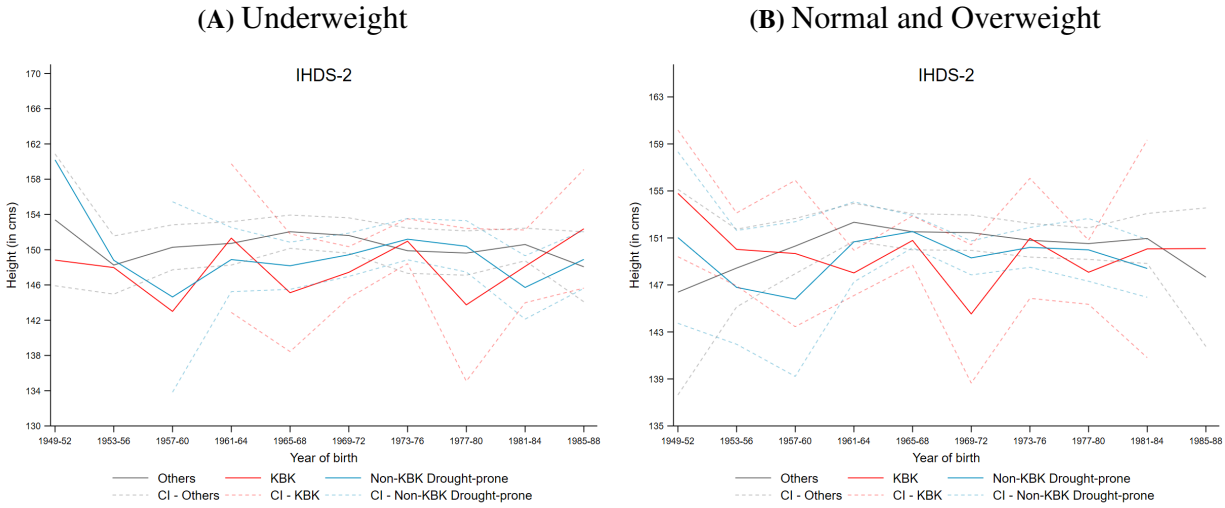
NOTE: Data Source is IHDS-2 data (2011-12). Jacknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Pre-trends in height of women born between 1966 and 1988, by ration card (Using NFHS data)

	(1) Height (in cms)	(2) Height (in cms)	(3) Height (in cms)	(4) Height (in cms)
KBK × Birth Year	-0.0307	-0.0332	-0.0559*	-0.0499*
	(0.0310)	(0.0233)	(0.0335)	(0.0280)
Non-KBK Drought Prone × Birth Year	-0.0386	-0.0093	-0.0542	-0.0243
	(0.0320)	(0.0282)	(0.0402)	(0.0416)
KBK	60.7643	65.1182	109.9263*	97.8488*
	(61.3059)	(46.0086)	(66.1640)	(55.4115)
Non-KBK Drought Prone	76.1345	18.1957	106.8118	47.5191
	(63.3072)	(55.6660)	(79.4946)	(82.2175)
Birth Year	0.0249	0.0399***	0.0229	0.0374***
	(0.0207)	(0.0135)	(0.0210)	(0.0136)
Constant	101.4495**	72.1939***	105.4317**	77.1966***
	(40.8295)	(26.6242)	(41.4424)	(26.9092)
Observations	7816	10709	5061	7969
R sq.	0.000	0.003	0.003	0.004
Ration Card	Below-Poverty-Line	Not Below-Poverty-Line	Below-Poverty-Line	Not Below-Poverty-Line
Sample	Full	Full	Restricted	Restricted

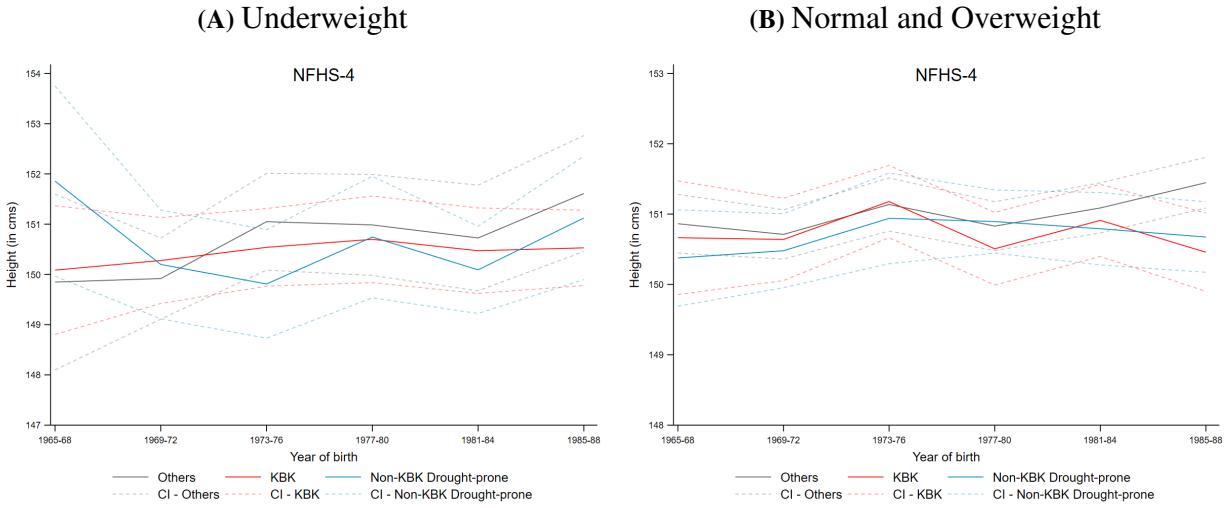
NOTE: Data Source is NFHS-4 data (2015-16). Unlike IHDS2, which asked detailed question on the type of ration card held, NFHS4 only asked respondents a yes or no question on whether they had a below poverty line card. Thus, in col 1 and 3 we report pre-trend regression results for below poverty line women and in Col 2 and 4, we report pre-trend regressions for Non-Below-Poverty-Line women which could potentially include women not holding any ration card. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 9: Pre trends in height of women born between 1949 and 1987, by baseline BMI status (Using IHDS data)



Note: The figure shows trends in women's height as measured in IHDS-2 (2011-12). The left panel shows trends for women who were underweight at baseline (2004-05) and the right panel shows trends for women who were normal or overweight at baseline (2004-05).

Figure 10: Pre trends in height of women born between 1966 and 1988, by BMI status (Using NFHS data)



Note: The figure shows trends in women's height as measured in NFHS-4 (2015-16). The left panel shows trends for women who are underweight and the right panel shows trends for women who are normal or overweight.

Table 5: Pre-trends in height of women born between 1949 and 1987, by baseline BMI status (Using IHDS)

	(1) Height (cms)	(2) Height (cms)	(3) Height (cms)	(4) Height (cms)
KBK × Birth year	-0.0882	0.0044	-0.2965	0.1849
	(0.2205)	(0.1148)	(0.4405)	(0.2542)
Non-KBK Drought-prone × Birth year	-0.0808	0.0070	-0.0099	0.1277
	(0.1333)	(0.0895)	(0.1212)	(0.1182)
KBK	171.6061	-10.5303	582.5700	-365.5624
	(434.5031)	(225.6698)	(867.3005)	(499.9166)
Non-KBK Drought-prone	157.5400	-15.1639	18.4220	-252.6002
	(262.7694)	(176.4361)	(239.5426)	(233.2638)
Birth year	-0.0185	-0.0047	-0.0566	-0.0200
	(0.0458)	(0.0426)	(0.0530)	(0.0490)
Constant	187.0453**	160.2073*	262.1901**	190.1518*
	(90.2798)	(83.9724)	(104.4809)	(96.6280)
Observations	412	856	250	558
R sq.	0.043	0.018	0.075	0.014
Baseline BMI status	Underweight	Normal, Overweight	Underweight	Normal, Overweight
Sample	Full	Full	Restricted	Restricted

NOTE: Data Source is IHDS-2 data (2011-12).Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Pre-trends in height of women born between 1966 and 1988, by BMI status (Using NFHS)

	(1) Height (in cms)	(2) Height (in cms)	(3) Height (in cms)	(4) Height (in cms)
KBK × Birth Year	-0.0610	-0.0387*	-0.0752	-0.0483*
	(0.0447)	(0.0200)	(0.0464)	(0.0248)
Non-KBK Drought Prone × Birth Year	-0.0789*	-0.0167	-0.1008**	-0.0269
	(0.0457)	(0.0206)	(0.0508)	(0.0280)
KBK	120.2661	76.3157*	148.1375	94.7419*
	(88.3036)	(39.4559)	(91.8418)	(48.9727)
Non-KBK Drought Prone	155.7427*	32.6492	198.9863**	52.6540
	(90.3105)	(40.6542)	(100.4975)	(55.2878)
Birth Year	0.0794**	0.0303***	0.0533*	0.0323***
	(0.0341)	(0.0109)	(0.0323)	(0.0119)
Constant	-6.2801	91.0421***	45.3775	87.2699***
	(67.3266)	(21.6179)	(63.8795)	(23.5115)
Observations	4183	14341	2752	10279
R sq.	0.003	0.001	0.003	0.004
BMI status	Underweight	Normal, Overweight	Underweight	Normal, Overweight
Sample	Full	Full	Restricted	Restricted

NOTE: Data Source is NFHS-4 data (2015-16). Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: DID Regression results for women holding Above-Poverty-Line ration card at baseline (2004-2005)

	(1) BMI	(2) BMI	(3) BMI
KBK × After 2008	0.1858	0.2735	0.3653
	(0.8682)	(0.8087)	(0.7905)
Non-KBK Drought-prone × After 2008	-0.1652	-0.5103	-1.0200*
	(0.8348)	(0.6760)	(0.6077)
KBK	-2.0734	-2.0153	-1.9505
	(1.6294)	(1.5927)	(1.5807)
Non-KBK Drought-prone	0.7053	0.3083	0.1534
	(1.6508)	(1.5249)	(1.5682)
After 2008	2.2861***	2.3074***	2.2976***
	(0.7202)	(0.6857)	(0.6639)
Observations	648	648	639
R sq.	0.310	0.324	0.313
Household Controls	Y	Y	Y
Individual Controls	Y	Y	Y
Month X Year Fixed Effects	Y	Y	Y
District Fixed Effects	Y	Y	Y
Sample	Full	Winsorized BMI	Trimmed BMI

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: DID Regression results for women holding Above-Poverty-Line ration card at baseline (2004-2005)

	(1) BMI	(2) BMI
KBK × After 2008	0.7742	1.7584***
	(0.5355)	(0.6209)
Non-KBK Drought-prone × After 2008	-0.1388	0.4097
	(0.7428)	(0.9733)
KBK	-3.7055**	-3.0464
	(1.5729)	(3.1310)
Non-KBK Drought-prone	-1.4544	-1.4988
	(1.8585)	(3.1110)
After 2008	2.4181	1.5140
	(1.6157)	(1.4791)
Observations	499	319
R sq.	0.376	0.476
Household Controls	Y	Y
Individual Controls	Y	Y
Month X Year Fixed Effects	Y	Y
District Fixed Effects	Y	Y
Sample	Excl. no card holders at endline	Excl. non Above-Poverty-Line at endline

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: DID Regression results for women holding Below-Poverty-Line ration card at baseline (2004-2005)

	(1) BMI	(2) BMI	(3) BMI
KBK × After 2008	1.6360***	1.5781***	1.1752**
	(0.4860)	(0.4915)	(0.5621)
Non-KBK Drought-prone × After 2008	-0.0729	-0.0462	0.0230
	(0.5248)	(0.5202)	(0.5269)
KBK	-2.4903**	-2.3582**	-1.7895*
	(0.9575)	(0.9301)	(0.9557)
Non-KBK Drought-prone	1.4382	1.4130	1.2926
	(1.0859)	(1.0815)	(1.0752)
After 2008	2.4417	2.5223	2.8177
	(2.2498)	(2.2282)	(2.1468)
Observations	1341	1341	1332
R sq.	0.257	0.255	0.234
Household Controls	Y	Y	Y
Individual Controls	Y	Y	Y
Month X Year Fixed Effects	Y	Y	Y
District Fixed Effects	Y	Y	Y
Sample	Full	Winsorized BMI	Trimmed BMI

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: DID Regression results for women holding Below-Poverty-Line ration card at baseline (2004-2005)

	(1) BMI	(2) BMI
KBK × After 2008	1.6023***	1.7780***
	(0.4869)	(0.5309)
Non-KBK Drought-prone × After 2008	-0.0758	-0.1997
	(0.6193)	(0.7199)
KBK	-2.4372**	-1.6977**
	(1.1364)	(0.8268)
Non-KBK Drought-prone	1.2907	2.1626*
	(1.3068)	(1.1779)
After 2008	2.4745	2.5828
	(2.3425)	(2.2756)
Observations	1230	1079
R sq.	0.267	0.265
Household Controls	Y	Y
Individual Controls	Y	Y
Month X Year Fixed Effects	Y	Y
District Fixed Effects	Y	Y
Sample	Excl. no card holders at endline	Excl. non Below-Poverty-Line at endline

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: DID Regression Results by women's BMI status at baseline (2004-2005)

	(1) BMI	(2) BMI
KBK × After 2008	1.5028***	0.7700
	(0.4802)	(0.5780)
Non-KBK Drought-prone × After 2008	-1.0054	-0.2225
	(0.6576)	(0.4613)
KBK	-0.4549	-1.2892
	(0.5813)	(0.9998)
Non-KBK Drought-prone	1.0396	1.9942**
	(0.9927)	(0.7628)
After 2008	2.1871	2.4716*
	(1.5117)	(1.3584)
Observations	814	1700
R sq.	0.248	0.283
Household Controls	Y	Y
Individual Controls	Y	Y
Month X Year Fixed Effects	Y	Y
District Fixed Effects	Y	Y
Sample	Baseline Underweight	Baseline Normal/Overweight

NOTE: Estimates have been generated using panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. In Col 1 we report regression results for women who at baseline were underweight (BMI $< 18.5\ m^2$) and in Col 2 we report results for women who were normal weight (BMI $>= 18.5\ m^2$ & BMI < 25 kg/m^2) and over weight (BMI $>= 25.0\ m^2$) at baseline. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: DID Regression results for women having Normal and overweight status at baseline (Robustness check)

	(1) BMI	(2) BMI
KBK × After 2008	0.7250	0.3918
	(0.5695)	(0.5929)
Non-KBK Drought-prone × After 2008	-0.3259	-0.4474
	(0.4313)	(0.4357)
KBK	-1.2627	-0.9010
	(0.9932)	(1.0268)
Non-KBK Drought-prone	1.8062**	1.7080**
	(0.7551)	(0.7648)
After 2008	2.4694*	2.4764*
	(1.3710)	(1.3953)
Observations	1700	1675
R sq.	0.292	0.291
Household Controls	Y	Y
Individual Controls	Y	Y
Month X Year Fixed Effects	Y	Y
District Fixed Effects	Y	Y
Sample	Winsorized BMI	Trimmed BMI

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: DID Regression results for rice consumption in last 30days, by baseline Above-Poverty-Line card holders

	(1) PDS Rice purchased (Dummy)	(2) PDS rice Purchased (IHS Kgs)	(3) Rice Consumption (Kgs)	(4) Rice Expenditure (Rs)
KBK × After 2008	0.3539**	1.3907**	-1.1981	-113.7397
	(0.1449)	(0.5676)	(7.3976)	(107.2821)
Non-KBK Drought-prone × After 2008	-0.0101	-0.0823	-5.6666	111.5055
	(0.1525)	(0.6472)	(8.5554)	(107.4436)
KBK	0.2989	1.2111	-8.5405	-298.8557
	(0.2106)	(0.8559)	(85.2839)	(816.6223)
Non-KBK Drought-prone	-0.1173	-0.4579	11.5639	223.0183***
	(0.1898)	(0.7870)	(11.0679)	(80.6185)
After 2008	0.4376	1.7842	1.0204	238.1993
	(0.3191)	(1.2938)	(6.4502)	(200.9704)
Observations	648	648	648	648
R sq.	0.409	0.410		
Household Controls	Y	Y	Y	Y
Individual Controls	Y	Y	Y	Y
Month X Year Fixed Effects	Y	Y	Y	Y
District Fixed Effects	Y	Y	Y	Y
Regression	FE	FE	Quantile	Quantile

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. IHS variables are inverse hyperbolic sine transformed variables. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 14: DID Regression results for rice consumption in last 30days, by baseline Below-Poverty-Line card holders

	(1) PDS Rice purchased (Dummy)	(2) PDS rice Purchased (IHS Kgs)	(3) Rice Consumption (Kgs)	(4) Rice Expenditure (Rs)
KBK × After 2008	-0.0670	-0.1339	6.6755*	-17.4592
	(0.1571)	(0.5757)	(3.8013)	(52.2422)
Non-KBK Drought-prone × After 2008	-0.1631	-0.5968	2.3241	-18.4299
	(0.1328)	(0.5042)	(3.3280)	(58.0775)
KBK	0.3992	1.6339	-16.8335*	-334.0808***
	(0.3426)	(1.3300)	(9.6670)	(115.2073)
Non-KBK Drought-prone	0.4591	1.8335	-3.5446	-203.2783***
	(0.3326)	(1.2992)	(6.3668)	(67.5634)
After 2008	0.4556	2.0294	12.1679	119.9618*
	(0.6903)	(2.5939)	(8.8373)	(64.6914)
Observations	1341	1341	1341	1341
R sq.	0.282	0.301		
Household Controls	Y	Y	Y	Y
Individual Controls	Y	Y	Y	Y
Month X Year Fixed Effects	Y	Y	Y	Y
District Fixed Effects	Y	Y	Y	Y
Regression	FE	FE	Quantile	Quantile

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. IHS variables are inverse hyperbolic sine transformed variables. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 15: DID Regression results for spending on other PDS items in last 30 days, Baseline Above-Poverty-Line cardholders

	(1) PDS Wheat Purchased (Dummy)	(2) PDS Wheat Purchased (IHS Kgs)	(3) PDS Sugar Purchased (Dummy)	(4) PDS Sugar Purchased (IHS Kgs)	(5) PDS Kerosene Purchased (Dummy)	(6) PDS Kerosene Purchased (IHS Kgs)
KBK × After 2008	0.1189	0.2873	0.0475	0.0413	-0.1138	-0.3797**
	(0.2322)	(0.6349)	(0.1252)	(0.1594)	(0.1231)	(0.1794)
Non-KBK Drought-prone × After 2008	0.0903	0.2263	0.1985*	0.2639*	0.1346	0.2660
	(0.1530)	(0.4346)	(0.1193)	(0.1582)	(0.1155)	(0.2240)
KBK	-0.0758	-0.2045	0.6609***	0.9888***	0.0150	-0.1701
	(0.2081)	(0.5730)	(0.1672)	(0.2178)	(0.1742)	(0.3422)
Non-KBK Drought-prone	0.5513***	1.5699***	-0.1858	-0.2928*	-0.0396	-0.1123
	(0.1305)	(0.4360)	(0.1254)	(0.1739)	(0.1672)	(0.3301)
After 2008	0.4336*	1.2714*	0.1642*	0.2418**	0.3757*	0.9543
	(0.2304)	(0.6699)	(0.0925)	(0.1196)	(0.2186)	(0.7846)
Observations	648	648	648	648	648	648
R sq.	0.375	0.405	0.241	0.237	0.202	0.183
Household Controls	Y	Y	Y	Y	Y	Y
Individual Controls	Y	Y	Y	Y	Y	Y
Month X Year Fixed Effects	Y	Y	Y	Y	Y	Y
District Fixed Effects	Y	Y	Y	Y	Y	Y

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. IHS variables are inverse hyperbolic sine transformed variables. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 16: DID Regression results for spending on other PDS items in last 30 days, Baseline Below-Poverty-Line cardholders

	(1) PDS Wheat Purchased (Dummy)	(2) PDS Wheat Purchased (IHS Kgs)	(3) PDS Sugar Purchased (Dummy)	(4) PDS Sugar Purchased (IHS Kgs)	(5) PDS Kerosene Purchased (Dummy)	(6) PDS Kerosene Purchased (IHS Kgs)
KBK × After 2008	0.0414	0.0879	0.1613*	0.2608**	0.0144	-0.2526***
	(0.0382)	(0.0964)	(0.0879)	(0.1099)	(0.0557)	(0.0924)
Non-KBK Drought-prone × After 2008	0.0078	0.0186	0.2778***	0.2385**	-0.0247	-0.0824
	(0.0386)	(0.1029)	(0.0907)	(0.1101)	(0.0498)	(0.1125)
KBK	0.0093	0.0118	-0.4321*	-0.7130	0.1646	0.5747***
	(0.1016)	(0.3188)	(0.2489)	(0.4435)	(0.1021)	(0.2073)
Non-KBK Drought-prone	0.0571	0.1300	0.1016	0.0569	0.1335*	0.2385
	(0.1137)	(0.3567)	(0.2517)	(0.4276)	(0.0706)	(0.1822)
After 2008	0.0900	0.2611	-0.0390	-0.1438	0.1104	0.1810
	(0.1537)	(0.4188)	(0.6375)	(0.8659)	(0.1712)	(0.6425)
Observations	1341	1341	1341	1341	1341	1341
R sq.	0.135	0.138	0.397	0.349	0.132	0.141
Household Controls	Y	Y	Y	Y	Y	Y
Individual Controls	Y	Y	Y	Y	Y	Y
Month X Year Fixed Effects	Y	Y	Y	Y	Y	Y
District Fixed Effects	Y	Y	Y	Y	Y	Y

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. IHS variables are inverse hyperbolic sine transformed variables. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 17: DID Regression results for likelihood of consumption of various food items in last 30 days, by Ration card status at baseline (2004-2005)

	Baseline Above-Poverty-Line		**Baseline Below-Poverty-Line**	
	(1) KBK X Post	(2) Non-KBK Drought-prone X Post	(3) KBK X Post	(4) Non-KBK Drought-prone X Post
Wheat	0.0713	-0.1776	-3.2440	-0.6591
	(0.1370)	(0.1302)	(2.3977)	(0.8960)
Sugar	0.0145	0.0647	0.3403	0.6403
	(0.0501)	(0.0482)	(0.5326)	(0.5442)
Other Cereals	0.1966*	-0.0073	-2.8417*	0.6602
	(0.1191)	(0.1951)	(1.6602)	(0.6986)
Pulses	-0.0480	-0.0674*	-0.5738	0.4133
	(0.0395)	(0.0401)	(0.7057)	(0.4258)
Meat/Chicken/Fish	0.0761	0.0172	-0.8198	0.2304
	(0.1066)	(0.0803)	(0.6565)	(0.3794)
Gur/Sweetners	-0.0401	-0.0514	-0.2647	-0.2918
	(0.1499)	(0.1627)	(0.2419)	(0.2981)
Edible Oil	0.0045	-0.0098	-0.7487	-0.0865
	(0.0074)	(0.0067)	(0.5255)	(0.3459)
Eggs	-0.0445	0.2701*	0.0121	0.1447
	(0.1325)	(0.1505)	(0.1628)	(0.1763)
Milk	0.0358	0.1919	-3.6932***	0.8745
	(0.2246)	(0.1323)	(1.2503)	(1.2169)
Milk Products	-0.1865	-0.0328	-34.6195***	-33.2059**
	(0.2024)	(0.1285)	(11.6291)	(13.3107)
Cereal Products	0.0071	0.0503	-0.0178	-35.1615
	(0.0665)	(0.1425)	(20.9064)	(21.3866)
Vegetables	-0.0275	-0.0165	-46.5576	-86.8438
	(0.0214)	(0.0148)	(55.2436)	(62.0042)
Processed Foods	-0.0386	-0.1216**	-39.7483**	-51.2615**
	(0.0896)	(0.0597)	(18.4492)	(22.7471)
Fruits and Nuts	-0.1456	-0.0177	-22.1441**	-16.0747**
	(0.3736)	(0.1676)	(8.9832)	(7.1154)
Restaurant Food/ Eating out	-0.1779	0.3023*	-8.2769	4.2589
	(0.1417)	(0.1678)	(29.0308)	(28.7667)

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. All the estimated results were obtained after controlling for individual and household characteristics, month-year fixed effects and district fixed effects. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 18: DID Regression results for consumption of various food items in last 30 days, by Ration card status at baseline (2004-2005)

	Baseline Above-Poverty-Line		**Baseline Below-Poverty-Line**	
	(1) KBK X Post	(2) Non-KBK Drought-prone X Post	(3) KBK X Post	(4) Non-KBK Drought-prone X Post
Wheat (IHS kgs)	0.0654	-0.5550	-0.4312	-0.1576
	(0.5210)	(0.3810)	(0.3506)	(0.2396)
Sugar (IHS kgs)	0.4484**	0.0390	0.0815	0.1804
	(0.2042)	(0.1993)	(0.1767)	(0.1445)
Other Cereals (IHS kgs)	0.3443	-0.0108	-0.5546	0.1225
	(0.2271)	(0.3289)	(0.3478)	(0.2049)
Pulses (IHS kgs)	-0.0246	-0.0791	-0.3264**	0.0569
	(0.2037)	(0.2329)	(0.1338)	(0.1200)
Meat/Chicken/Fish (IHS kgs)	-0.3168	-0.0136	-0.1063	0.2494
	(0.2479)	(0.2473)	(0.1570)	(0.1697)
Gur/Sweetners (IHS kgs)	-0.3036	-0.0594	-0.0768	-0.1538
	(0.2931)	(0.1707)	(0.1372)	(0.1633)
Edible Oil (IHS litres)	0.1532	-0.0368	-0.2352	0.1425
	(0.1861)	(0.1617)	(0.1744)	(0.1116)
Eggs (IHS dozens)	-0.0942	0.1971	-0.0160	0.1172
	(0.1435)	(0.1382)	(0.1058)	(0.1288)
Milk (IHS litres)	-0.1177	0.4515	-0.4587**	0.3378
	(0.6640)	(0.4853)	(0.1932)	(0.2416)
Milk Products (IHS Rs)	-1.4428	-0.3124	-1.2955**	-0.3385
	(0.9610)	(0.5966)	(0.5380)	(0.5596)
Cereal Products (IHS Rs)	-0.1404	-0.2269	1.4408***	-0.3112
	(0.3948)	(0.7587)	(0.4414)	(0.4943)
Vegetables (IHS Rs)	-0.2258	-0.1826	-0.3149*	0.0609
	(0.3080)	(0.3041)	(0.1791)	(0.1782)
Processed Foods (IHS Rs)	-0.3495	-0.7640*	-1.1818***	-0.4394
	(0.5287)	(0.3994)	(0.3230)	(0.4109)
Fruits and Nuts (IHS Rs)	-0.8213	-0.2743	-0.8450**	-0.8198
	(1.6709)	(0.6624)	(0.4231)	(0.4996)
Restaurant Food/ Eating out (IHS Rs)	-0.7497	1.9622*	0.0820	0.9372
	(0.8578)	(1.0028)	(0.5507)	(0.6134)

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. We Inverse Hyperbolic Sine (IHS) transform all the dependent food consumption variables listed above. All the estimated results were obtained after controlling for individual and household characteristics, month-year fixed effects and district fixed effects. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 19: DID Regression results for Medical, educational and other HH consumption spending in last 365 days, by Ration card status at baseline (2004-2005)

	Baseline Above-Poverty-Line		**Baseline Below-Poverty-Line**	
	(1) KBK X Post	(2) Non-KBK Drought-prone X Post	(3) KBK X Post	(4) Non-KBK Drought-prone X Post
Outpatient medical care (last 30 days, in IHS Rs)	0.6782	1.0039	-1.0405*	-0.3705
	(0.9675)	(0.6566)	(0.5656)	(0.7045)
Medical spending (IHS Rs)	-3.1067***	-0.3597	-4.6588***	-1.8071*
	(1.1552)	(1.3064)	(0.7741)	(0.9626)
Education related spending (IHS Rs)	2.4281***	-1.4895*	0.0437	-0.6277
	(0.8719)	(0.8736)	(0.6482)	(0.6761)
Jewelry & ornaments (IHS Rs)	-1.3536	-0.6623	-1.6738***	-1.3614*
	(1.1559)	(1.1567)	(0.5123)	(0.7224)
Personal transport equipment (IHS Rs)	2.5113***	1.9448*	0.7841	2.1565***
	(0.7611)	(0.9996)	(0.6895)	(0.7823)
Repair & Maintainance (IHS Rs)	-1.5069	-0.7149	0.9000	0.1862
	(1.1511)	(1.6219)	(0.8625)	(1.1833)
Insurance premiums (IHS Rs)	2.4098**	0.5455	0.8487	0.1670
	(0.9746)	(1.3104)	(0.5747)	(0.5351)
Holidays/vacations (IHS Rs)	-1.3503	-0.5977	-1.5038***	-1.7155**
	(1.0777)	(0.9804)	(0.5085)	(0.7481)
Social functions (IHS Rs)	-0.7865	0.1786	-0.2121	-0.6081
	(0.6933)	(0.5770)	(0.6783)	(0.5758)
Other household spending (IHS Rs)	-1.1943	-0.1338	-0.1531	0.1586
	(0.8081)	(0.2650)	(0.3223)	(0.2137)

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. We report regression results for Inverse Hyperbolic Sine (IHS) transformed variables of medical, education and various household spending. Other household spending variable listed in the last row includes total household spending on clothing, bedding, footwear, furniture, utensils, household appliances, recreational goods and other personal items. All the estimated results were obtained after controlling for individual and household characteristics, month-year fixed effects and district fixed effects. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 20: DID Regression results for asset ownership in last 365 days, by Ration card status at baseline (2004-2005)

	Baseline Above-Poverty-Line		**Baseline Below-Poverty-Line**	
	(1) KBK X Post	(2) Non-KBK Drought-prone X Post	(3) KBK X Post	(4) Non-KBK Drought-prone X Post
=1 if agricultural land owned/cultivated	-0.0794 (0.0914)	0.0578 (0.0796)	-0.1347* (0.0807)	-0.1176 (0.0717)
=1 if house lived in is owned	0.0060 (0.0340)	-0.0136 (0.0378)	-0.0163 (0.0144)	-0.0091 (0.0191)
=1 if any farm asset owned	0.2718 (0.1933)	-0.1849 (0.2453)	0.1750 (0.1084)	0.0117 (0.1080)
IHS total farm asset owned	0.1877 (0.2373)	-0.2030 (0.2749)	0.1766 (0.1107)	0.0604 (0.1058)
=1 if livestock owned	-0.0514 (0.1156)	0.0448 (0.1346)	-0.3878*** (0.0793)	-0.1433* (0.0765)
IHS total liverstock owned	-0.1799 (0.2689)	0.0363 (0.2709)	-1.2751*** (0.2553)	-0.5637** (0.2204)
Number of asset type owned	0.4264 (0.5331)	0.9402 (0.5963)	0.2881 (0.3556)	-0.1983 (0.4185)

NOTE: Data Source is panel IHDS-1 and IHDS-2 women's data. IHDS surveys include HHs sampled from 26 out of 30 districts in Odisha. We Inverse Hyperbolic Sine (IHS) transform total farm asset and livestock owned variables. When measuring farm asset ownership, we have considered ownership of tubewells, electric pumps, diesel pumps, bullock cart, tractor, and thresher. When measuring livestock ownership we have considered ownership of milch cows, milch buffalo, draft animals, goats, sheeps, poultry/chicken/ducks and others animals such as pigs, calves, camels etc. Asset score has been constructed by summing up each household asset type owed by the household including cycle, sewing machine, generator set, mixer/grinder, motor cycle/scooter, black and white TV, color TV, air coller, clock/watch, electric fan, chair/table, cot, telephone, cell phone, fridge/refrigerator, and pressure cooker. All the estimated results were obtained after controlling for individual and household characteristics, month-year fixed effects and district fixed effects. Jackknifed standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.