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A food security experiment in remote areas: Evidence from indigenous India

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Abstract

We examine whether grain banks, a food security intervention in rural India, have improved health indicators, in particular children's anthropometric scores. We also examine whether grain banks reduce moneylender dependence, given that they provide member households with consumption credit at more favorable terms, in a region with few alternatives. Given that households in this region largely borrow to cope with seasonal food shortages, we expect to see improved food security and reduced moneylender dependence. Using household survey data collected from indigenous Odisha in villages with surviving grain banks and villages where grain banks were never set up or were short-lived, and applying propensity score matching, we find that while grain bank participation had no impact on health outcomes, it reduced the incidence of borrowing from moneylenders. Given the poor sanitation environment in indigenous Odisha and the critical role it plays in improving nutritional outcomes, our findings of reduced moneylender reliance but no health improvement can easily be reconciled. The institutional discussion points to the potential of grain banks to act as the first line of defense in the war on hunger, in particular seasonal hunger, especially in remote regions.

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Section 1. Introduction

In this study, we examine the impact of innovative village-level food security and savings institutions in indigenous Odisha, called grain banks, on food security and credit outcomes. Grain banks provide loans in the form of grains to member households, typically during the agricultural lean season. These loans are to be returned with interest, also in the form of grains, during the following harvest season. By extending consumption credit, grain banks provide households with the opportunity to smooth food consumption over the agricultural cycle. In particular, by being located in isolated areas, grain banks can act as the first line of defense against food-security shocks, and respond more rapidly and nimbly, especially compared to larger but centralized programs such as India's Public Distribution System (PDS) or the Integrated Child Development Scheme (ICDS). Being located in regions with few credit and savings alternatives, grain banks also offer an alternative avenue for credit and savings management.

Since India has a large indigenous population (collectively referred to as Scheduled Tribes (ST) per the Indian Constitution), addressing their problems is critical for national and global development targets. Numbering over 104 million, the ST population of India has poorer nutrition, health and other socio-economic indicators compared to the non-ST population in the country. It follows that the state of Odisha, home to one of the largest ST populations among Indian states, also has very poor nutrition and health indicators. For example, NFHS-3 estimates indicate that the proportion of underweight children below 5 years in Odisha and for ST communities in Odisha, was 41% and 54% respectively, compared to the national average of 43%.

While the elimination of food insecurity is a pressing priority in itself, the urgency to do so in ST-majority areas is heightened because of growing Maoist-inspired violence in the so-called "Red Corridor" in eastern and central India, which overlaps with districts with a large ST population (Bhattamishra 2012b). In this scenario, innovative thinking is of prime importance, and ascertaining the efficacy of newer programs and institutions that promote food security can enable the government to allocate limited resources effectively. And given that the ST population typically lives in remote areas, examining an intervention that can address food security in remote areas is of critical importance.

Grain banks are one such innovative local intervention being implemented by rural and tribal nongovernmental organizations (NGOs)[2]. They were also implemented by the Government of India (GoI)'s Ministry of Tribal Affairs for food security purposes. As part of its Village Grain Bank Scheme, GoI had introduced grain banks for Below Poverty Line (BPL)/Antyodaya households in chronically food-scarce regions, ostensibly to address seasonal food insecurity and acute food shortfalls due to natural disasters (GoI 2009). International donor agencies (often in partnership with local NGOs) have also introduced grain banks in food-insecure regions (see, for example, WFP 2010).

However, to the best of our knowledge, econometric studies that examine the impact of grain banks in India are lacking, although anecdotal evidence extolling their benefits abounds. Given this lacuna, we examine the impact of grain banks on food security outcomes. For our analysis, we use matching-based estimators which we argue make the best use of the data at hand. In addition, given anecdotal evidence that grain banks serve as an alternate source of (consumption) credit and savings mobilization in a region with few or no options, we also examine the impact of borrowing from grain banks on dependence on borrowing from informal moneylenders. Specifically, we answer the following questions:

1. *What is the impact of grain banks on child health?*
2. *What is the impact of grain banks on the incidence of borrowing from local moneylenders?*

For our study, we use data from a dedicated household survey implemented in Rayagada district in rural Odisha. The study site was selected for 4 reasons. First, the state of health and food insecurity in Odisha, especially in its ST areas, is alarming. Households in the study area are desperately poor – over 94% (and 95%) of households reported that adult males (and females) faced food insufficiency in at least 2 months during the preceding year; 14.2% of households surveyed have had at least one child 5 years or younger who died in the 5 years preceding the survey, and almost three-quarters of children who died succumbed to preventable diseases like cold, fever and gastrointestinal issues like diarrhea.[3] Second, households borrowed small loans (about Rs. 1090 or 16 US$) from local moneylenders at average interest rates as high as 50%.

[2]The indigenous population of India is commonly referred to as its tribal or ST population (Bhattamishra 2012b). In this paper, the words indigenous, tribal and ST are used interchangeably to indicate the same population.
[3]Morbidity figures based on data collected from 499 households in the monsoon or rainy season. During the monsoon, the village of Gulmijholla, which was surveyed in the harvest season, could not be accessed due to an outbreak of a cholera epidemic there.

By offering an alternate source of credit at a lower interest rate, grain banks have the potential to increase household welfare. Third, grain banks were established *en masse* in this region in the 1980s and 1990s, providing a reasonably long time period for examining the questions of interest. Fourth, Agragamee, the NGO that introduced the grain banks under study, was a pioneer of the grain-bank movement in Odisha and was open to independent research of its initiative. Given the difficulties of partnering with governments for implementing independent evaluations, it was felt that implementing a regional evaluation could provide a valuable starting point to conducting regionally broader, possibly randomized evaluations, perhaps with more treatment arms that could inform the design of future "grain banks".

We estimate grain bank impact by comparing outcomes of interest between children and households in villages with grain banks (which we refer to as grain bank villages or GBVs) and children and households in villages without (which we refer to as non-grain bank villages or NGBVs), using propensity score matching (PSM) methods to construct a comparable group. Since grain bank location and participation are endogenously determined, we implement a dedicated survey for gathering data on factors that potentially explain program location and participation as well as outcomes of interest, after extensive discussions with implementing staff and grain bank beneficiaries. We argue that our data meet the necessary requirements for PSM to provide valid impact estimates. Even though this is an *ex post* evaluation, we argue that it makes an important contribution to food security concerns in remote areas in India by providing preliminary evidence on grain banks, using an evaluation method best suited to the available data and exploring not just food security, but also an important outcome beyond food security.

In the following section, we provide some stylized features of grain banks as well as discuss potential reasons for their continued existence. In Section 3, we review studies on the impact of consumption shocks on health which motivated our initial interest in the grain bank intervention. Since grain banks can also serve as a savings and credit institution, we also review studies of rural financial markets in developing countries and the growing literature on savings demand in such countries. In Section 4, we provide a descriptive account of the sample villages and households in our study. In Section 5, we discuss the appropriateness of PSM, our chosen methodology. In Section 6, we present our main findings on health as well as borrowing from local moneylenders. In the last section, we summarize our findings and conclude.

Section 2: Institutional features of grain banks

Insight into the main institutional features of grain banks can be gained by comparing them to another similar-sounding food security intervention - the cereal banks in the Sahel region in Africa. For over three decades, a number of nongovernmental organizations (NGOs), international humanitarian agencies such as the Food and Agricultural Organization (FAO) and the World Food Programme (WFP) and international funding bodies such as the World Bank have been establishing cereal banks for both commodity price stabilization and combating short-term food shortages (CRS 1998, Practical Action 2006, IRIN 2008), World Bank 2011, 2015). Case studies of how cereal banks have helped communities achieve greater food security abound. This qualitative evidence is supplemented by quantitative evidence by Gross et al. (2015), who use a controlled randomized design and long-term data from an intervention in Burkina Faso and find a positive impact of cereal banks on adult and children's BMI, with a stronger effect for more remote households.

Prima facie, the institutions appear to be very similar. Both are community-based food security interventions. They are initiated by an external agent and subsequently managed by members. However, the main objective of cereal banks is to enable commodity price stabilization across the agricultural cycle through the provision of a physical storage facility. On the other hand, the main objective of grain banks is to enable consumption smoothing across the agricultural cycle through the provision of consumption credit, and it does not depend on the provision of a dedicated physical storage facility. Unlike cereal banks, grain banks provide mainly institutional infrastructure.

However, the potential of grain banks to promote food security by saving, averting starvation or reducing the likelihood of bonded labor by providing an in-kind savings and credit alternative, especially in remote areas, has not been highlighted, nor the viability of grain banks in the face of covariate shocks like drought and possible linkages with existing food security schemes discussed in high-level policy circles. As a result, many grain banks have collapsed, and support for the scheme in the government has dried up. Nevertheless, local NGOs continue to implement and support grain banks in marginalized and remote areas in India.[4] Recently, the

[4] Examples include Pragati Gramodyog evam Samaj-kalyan Sansthan (PGS) in tribal UP and Pragati Gramin Vikas Samiti (PGVS) in extremely remote, marginalized areas in rural Bihar.

state government of Bihar has instituted grain banks to promote food security for BPL families in remote villages.

The following discussion of stylized features of the Indian grain bank is informed mainly by the grain banks implemented by the NGO Agragamee in tribal Odisha and those by the Indian government's Ministry of Tribal Affairs Grain Bank Scheme, although many significant features are similar to other Indian grain banks.

What are grain banks? Grain banks fall under the rubric of membership-based voluntary community-based organizations (CBOs) that play a prominent role in the provision of credit, insurance and other financial services, especially in rural areas in developing countries where formal financial institutions are largely absent. They are membership-based, in that they are owned and managed completely by the beneficiaries themselves.

Grain banks in tribal Odisha are a descendent of the traditional system of grain *golas* in tribal villages, where surplus grains post-harvest were collected into a common pool which was controlled by the traditional village head and from which disbursements were largely discretionary.

The current grain bank provides consumption loans to member households in the form of grains, typically during the agricultural lean season, to be returned with interest, also in the form of grains, during the following harvest season. By lending and collecting loans in kind, grain banks fit into the barter system familiar to the indigenous population. In the absence of formal credit markets, they provide an alternative source of (consumption) credit at interest rates lower than those charged by local moneylenders, without the threat of the loss of collateral.

Why did grain banks originate in their current form? Given the disappearance of the traditional safety net arrangement, issues of poor coverage and irregular supply endemic to public food security programs especially in remote areas, as well as the recurring occurrence of seasonal food shortages and hunger in these parts, grain banks were introduced by social activists as a community-level solution that was not susceptible to the vagaries of these programs. To some extent, the source of inspiration for grain banks is also found in the Self-Help Group (SHG) movement in the informal banking sector in India (see Morduch and Rutherford 2003 for a discussion on the SHG movement). Both grain banks and SHGs are

member-owned organizations that provide consumption credit, though grain banks lack the feature of joint liability which typifies many SHG credit schemes.

How are grain bank contracts enforced? While grain banks do not share the feature of group lending that is central to micro-finance institutions (MFIs), they do share some other critical mechanisms that enable contract enforcement, such as peer monitoring, the threat of social sanctions and dynamic incentives. First, indigenous agrarian societies are bound by close ties of clan and kinship, and individuals typically possess a rich set of information regarding fellow members. As a result, peer monitoring can be an effective and low-cost instrument for attenuating moral hazard problems. Second, the cost of social sanctions is high. Therefore, the threat of social sanctions can maintain high repayment rates and overcome free rider problems in activities with a public good character, such as peer monitoring and auditing. Third, since seasonal food shortages in tribal Odisha can be interpreted as a repeated game in which there are few (and probably no better) alternatives than grain banks, dynamic incentives, whereby loan sizes are increased over time, can also help in contract enforcement, as shown by Morduch (1999) and Alexander (2006). Finally, informal contracts can become self-enforcing since members of a small, traditional rural community typically interact with the same individuals on a repeated basis over long periods of time and the short-term benefits from reneging are much smaller than the long-term costs (Posner 1980, Coate and Ravallion 1993). As a result, even in the absence of formal legal courts, informal contracts such as in grain banks can be self-enforcing and address informational and enforcement problems (Platteau 2000).

Start-up amount, management, quality control and disbursement: In the Indian government grain bank program, each grain bank received an initial grant of 100 kilograms of grain per member household. Contributions by member households were not required. In NGO grain banks, no specific quantity of grains is required at start-up.[5] Resource constraints, as also the fact that matching contributions by member households are required, may be a determinant of low grain bank stocks at start-up for NGOs, which in turn may affect institutional sustainability.

Management is implemented by a committee that includes elected or selected individuals from among grain bank members. Typically, in NGO grain banks, the majority of

[5]Although Agragamee is a data-driven organization, most of its initial grain banks records were lost after its offices were ransacked following mining and other unrests in this region.

committee members is required to be female as they are perceived to be more heavily invested in grain-bank success. Although decisions on loan amounts and interest rates are typically made by the member community, the grain-bank committee is responsible for collections, disbursements and bookkeeping.

In the Indian government's grain bank program, existing leadership groups such as the Village Panchayat/Gram Sabha (village-level governing bodies), Self Help Group (village microcredit programs) NGOs, etc., identified by the State Government were eligible for running the grain banks (Government of India 2009). Although there are no specific guidelines on how quality control is maintained, anecdotal evidence reveals that the type of grain stored is important from a quality perspective, as grains that can withstand the local climate better and are more resistant to pests experience a lower rate of loss in storage.

Grain bank membership, interest rates, and storage: The typical grain bank does not sell grain on the market. Loans are accessible only to contributing members. However, grain bank participation is voluntary, and the majority of households in villages with grain banks participate, being food-insecure. The main grains borrowed from grain banks were a local millet and paddy rice. The average grain loan for both types of grains was about 12 kg. Grain bank loans were provided at an interest rate usually between 25–50%, lower than the interest rates charged by local moneylenders, thus making grain banks an attractive alternative source of credit.

The interest rate is determined by the member community (with technical guidance from the NGO staff, in many cases) and can vary from year to year, depending on the year's output and needs (for example, if the harvest is good, then interest rates may be increased so that there are larger stocks for the following year). Defaulters do not immediately lose grain-bank membership. Instead, they are typically given a grace period and are asked to return their loans with interest in the following harvest season.

While the government grain bank scheme had a provision for a dedicated storage facility, no physical storage facility was included in the majority of NGO grain bank interventions. Instead, a common area, such as in a school or the village headman's home, was used for storage.

Potential benefits of grain banks:

1. Promote food security by being local: Grain banks can build local food stocks, respond to food shortages quicker than larger, more centralized programs since they are situated in the beneficiary community, and involve no transportation or distribution lags. They can build local capacity and involve community participation which often (though not always) improves targeting outcomes, lowers information, and enforcement costs that typically characterize community-based contracts, and mimic systems familiar to the target population.

2. Promote consumption smoothing through risk management: Grain bank membership is confined to members of the same village, and individual grain banks are not linked to a national or sub-national reserve. Therefore, these institutions cannot help member households cope with covariate risk such as climatic shocks. However, in many cases, grain bank loans are state-contingent: households that defaulted on loans due to crop failures, sickness, weddings, etc., typically do not lose grain bank membership; instead, their loan repayment period was extended. Therefore, to some extent, grain banks provide member households with insurance against idiosyncratic risks (though this is not their main objective).

3. Promote consumption smoothing by addressing intra-household allocation issues: The need for an institution that provides "spousal control" may be relevant in tribal Odisha, given informal interviews which indicate that the unitary model of household decision-making may not be a correct representation. One piece of evidence is the presence of anti-liquor campaigns by women against liquor consumption by men in their households, which suggests differing preferences over the allocation of income to expenditures. Since the grain bank committee, which oversees management of grain banks, is typically dominated by women, they may provide women with greater spousal control. Therefore, similar to financial savings institutions like rotating savings and credit associations (ROSCAs), grain banks can enable savings by providing spousal control (see Anderson and Baland (2002) for a discussion of how ROSCAs enable savings by providing spousal control).

4. Promote consumption smoothing by lowering social taxation: In a tightly-knit, small community like in tribal Odisha, saving by oneself may not be efficient as it may be vulnerable to high rates of social taxation due to requests from relatives and neighbors during times of need. However, saving in a community-level institution such as a grain bank, where decisions

on disbursement are made only a few times a year and require the sanction of the management committee, can lower the rate of social taxation, thereby making the savings decision attractive (see Armendáriz and Morduch (2004) for how social taxation can deter informal financial savings in poor households).

5. Promote consumption smoothing by addressing self-control problems: Informal interviews with both NGO staff and members indicate that grain banks "cultivated" a savings habit which did not seem to exist before. While the lack of an existing savings habit could be a rational response to the lack of appropriate storage facilities, grain banks were enabling savings even without building one. This could indicate that grain banks can address time-inconsistent preferences and serve as a commitment savings product, potentially enabling savings for members with self-control problems. Self-control problems may be more acute in the poor, who face more difficult choices (Mullainathan 2009), and savings devices that address self-control problems are seen throughout the world (e.g., Rutherford 1999, Gugerty 2001, Ashraf et al. 2003, Ashraf et al. 2006).

Section 3. Literature review

This section provides some context for the main objectives of grain banks by reviewing some literature on seasonal food insecurity, consumption shocks and rural credit markets.

Seasonal food insecurity, consumption shocks and health outcomes: A growing number of studies document seasonal food shortages and the adverse impact of households' inability to smooth consumption across the agricultural cycle on health outcomes (e.g., Christian and Dillon (2018), Abay and Hirvonen (2017), Khandker and Mahmud (2012), Devereux et al. (2012), Zeller et al. (1998), Branca et al (1993), Sahn (1989)). There is also evidence that reduced food intake during the lean season has a negative impact on future agricultural productivity (e.g., Behrman and Deolalikar 1989) and that seasonal food shortages lead to losses in female body weight as well as low birth weights (e.g., Lawrence et al. 1989) which have negative implications for the (intergenerational) persistence of poverty. Given that lower birth weights are associated with lower height attainments in childhood and adulthood, and a consequent reduction in potential earnings, we can conclude that seasonal fluctuations in consumption not only have negative short-term effects but also negative long-term impacts (e.g., Martorell 1995,

1999; Glewwe and Jacoby 1995). A few studies also discuss the importance of extending consumption credit in order to enable agricultural households to smooth consumption and break the cycle of low productivity, depleted asset holdings, low output and food insecurity (Zeller et al. 1998).

Health outcomes of young children are of particular interest not only because of concern over their immediate welfare, but also due to the fact that nutrition in early childhood plays a crucial role in future physical and mental development, thereby affecting health status as adults and future labor productivity (see review by World Bank 2006 and Grantham-McGregor et al. 2007). Although, like for adults, inability to smooth consumption can lead to worse short-term welfare outcomes for children, poor health outcomes in childhood can have long-term negative consequences for their future physical and mental development, thereby affecting health status as adults and future labor productivity. A growing body of literature also provides empirical evidence on the negative impact of adverse shocks on children's health outcomes, both concurrent and in the long-term (Hoddinott and Kinsey 2001, Dercon and Hoddinott 2005, Alderman, Hoddinott and Kinsey (2006), Hoddinott 2006).

Given the above, we examine whether grain banks, whose main function is to smooth food consumption across the agricultural cycle, indeed improve children's health outcomes, using height-for-age (or *haz* scores), weight-for-height standardized *z*-scores (or *whz* scores) and children's change in height.

By promoting food consumption via savings/credit, grain banks also provide a valuable financial market alternative. Rural financial markets in tribal Odisha, like those across developing countries, suffer from many market failures, due to asymmetric information, enforcement problems and credit rationing (see, among others, Karlan and Zinman (2007) in South Africa, Aleem (1990) in Pakistan, Gine and Klonner (2005) in India, Zeller (1994) in Madagascar, Diagne (1999) and Zeller et al. (1998) in Malawi, Barham et al. (1996), Boucher and Guirkinger (2005), and Boucher et al. (2005) in Guatemala, Peru, Honduras, and Nicaragua).

Food access problems are particularly acute during agricultural lean seasons, due to the lack of appropriate food storage facilities and credit constraints (Basu and Wong 2015), high prices and credit constraints (Burke 2004, Stephens and Barrett 2011) and distance from markets (Abay and Hirvonen 2017). The absence of savings to confront anticipated shocks such

as food shortages in the lean season also indicates the lack of appropriately-designed savings and storage products that take self-control, inattention and mental accounting problems into consideration (e.g., Ashraf et al. 2006, Gugerty 2001, Dupas and Robinson 2013).

Villagers in remote, rural areas such as tribal Odisha are subject to some of these same problems that affect rural financial markets in developing countries generally. In the absence of formal lending institutions, credit is often provided by informal moneylenders who accept labor as collateral, leading to tied labor-credit contracts. Such contracts are commonly observed across rural economies in the developing world (Bardhan 1983; Eswaran and Kotwal 1985a, Hoff et al. 1993, Mukherjee and Ray 1995).[6]

However, few studies examine how new lending institutions affect borrowing from informal moneylenders. An exception is Kaboski and Townsend (2005), who use data from Thailand to study the impact of four different microfinance institutions (MFIs) including rice banks (which are identical to grain banks) – on reliance on informal moneylenders, among other welfare outcomes.[7] In the case of grain banks, like any new financial market alternative, they too can affect traditional, informal credit and savings sources. Given this, we also review the impact of grain banks on moneylender reliance.

[6]Bonded labor in tribal Odisha due to credit from the local moneylender is poignantly depicted in the novel '*Paraja*' by the Oriya novelist Gopinath Mohanty. Although the novel was written decades ago, some of its concerns remain depressingly contemporary.

[7]A few studies (eg., Navajas et al. (2003), McIntosh et al. (2005)) examine the impact of competition on lending relationships more broadly.

Section 4: Background

The data used in this study come from a small survey in Rayagada district in southwest Odisha in the so-called "tribal belt" of the state, which comprises districts where the majority of the population is ST. Home to the largest number of ST communities currently recognized by the Indian government – 62 out of more than 700 across India, each with distinct languages and cultures – Odisha also has one of the highest concentrations of ST populations among Indian states (over 9.5 million people or about 22 percent of its population, compared to about 9 percent across India). The ST population of Odisha is extremely disadvantaged regardless of the metric used. Poverty is high, literacy low, access to clean water low, open defeacation rates and food insecurity are high. Selected self-reported food insecurity statistics are in the table below. Note that the households considered low food consumption during the agricultural lean months as normal; food shortages reported should therefore be interpreted as shortages over the norm.

Table 1. Food insecurity perceptions

At least 3 months in 12, share of households where "x" was forced to:	x=Adult males	x=Adult females
Eat insufficient food	0.95	0.96
Eat less preferred foods	0.95	0.95
Skip all meals in a given day	0.13	0.10

Note: Data from 499 households in the agricultural "lean" season.

Given the high rate of food insecurity, we conducted a small grain bank and household panel survey in Kashipur block, Rayagada over August-October 2005, in the post-harvest season and towards the end of the "hungry" season, when food shortages are at their peak. Table 2 shows comparable statistics for Rayagada district from the last census. Given the low level of development in that region then, we argue that the findings from our survey would be similar even if the data were collected today.

Table 2: Selected development indicators

Statistic	Sample villages[a]	Rayagada district[b]
Percent of females age 6-14 attending school	31.9	34.2
Percent of households with electricity	0.9	0.12
Percent of households with no toilet/ latrine facility	99.6	94.6

Source: a. Household survey data collected in winter 2005. b. Census 2011 data for rural population in Rayagada or ST population of Odisha. Rayagada has one of the largest ST populations among Odisha's districts.

Sampling and survey design: A total of 26 villages were randomly sampled from a set of approachable villages in Kashipur block, stratified by grain bank status and village size. The final sample included 13 villages with operational grain banks at the time of the survey (referred to, hereafter, as grain bank villages or GBVs) and 13 where grain banks were non-operational at the time of the survey (referred to, hereafter, as non-grain bank villages or NGBVs). In each sampled village, a list of all households was drawn up, and 20 households randomly sampled from the list. Table 3 provides sample size and some statistics on food insecurity and moneylender reliance. Details on the survey are in the Appendix.

Table 3: Overview of sample

Statistic	All villages	Grain bank villages (GBVs)	Non grain bank villages (NGBVs)
N (P)/ N(L)	28/ 26	14/ 13	14/ 13
No. of households (P) / (L)	544/ 499	269/ 250	275/ 249
No. of children below 6 years (L)	375	263	308
Share of children who are stunted (L)	0.58	0.59	0.56
Share of children who are wasted (L)	0.37	0.37	0.37
Share of loans from local moneylenders (L)	0.57	0.53	0.60

Source: L= Lean season. P = Post-harvest season.

Food consumption: Food consumption in this region is tied closely to the agricultural calendar and its composition changes with the seasons. Almost all households cited agriculture as their

main occupation; however, since agriculture is rain-fed, both production and consumption were tied to the vagaries of rainfall. Since there was no drought in the survey year, food consumption followed the norm in that region. Between October-February, when produce was harvested, the indigenous population consumed staples such as rice and millet. Between March-May, consumption depends on food stocks as well as purchases using earnings from daily wage labor (mainly in labor-intensive public works programs). Food shortages are common in the 'hungry' season (June-September), since food stocks are depleted and opportunities for daily wage labor shrink due to the monsoon rains.[8] Average body weight declines in the hungry season. For example, the average weight of adult women declined from 42.3 kg in the post-harvest season to 40.9 kg in the lean season. The difference is statistically significant at the 1% level.

Data on coping strategies mirrors the weight reduction: households reduce consumption in the face of shocks – anticipated and unanticipated. Borrowing from local, private informal moneylenders is the second-most common coping strategy (see Table 4 for details.)

Table 4: Coping strategies used to manage shocks

Coping strategies	Share of households (in percent)
Reduce consumption	56.9
Borrow from local moneylender	22.6
Transfers from friends and family	10.0
Sale of assets (agricultural tools, livestock, land, other)	7.0
Other (increase labor supply, transfers from govt. and NGO, etc.)	3.5

Notes: Shares reflect reports of coping strategies ever used for up to the 3 most recent shocks, conditional on experiencing a shock in the 5 years preceding the survey. Over 60% of households reported facing 1 or more shocks in the 5 years preceding the survey. Note that this share refers to shocks outside the norm: a reduction in food consumption and experience of hunger during the monsoon is considered normal. Of the households who reported facing shocks, 41 percent report using more than 1 risk-coping mechanism while 7 percent report using 3 risk-coping mechanisms.

[8]During this period, meals are limited to gruel made from millet flour or flour from dried seeds (tamarind and mango).

Given the widespread dependence on moneylenders for risk-management, we present an alternative view in Table 5 by examining why households choose to borrow from them. Almost three-quarters of households cited that their primary reason was to meet food and household expenses.

Table 5: Reason for loan from moneylender

Reason	Share of loans (percent)
Food/ household expenses	72.2
Agricultural expenses	9.0
Home repairs	6.8
Medical treatment	6.0
Other (Trade, Wedding expenses, etc.)	6.0
Total	100.0

Notes: Shares are conditional on reporting an outstanding loan from the moneylender at the time of the survey.

Since moneylenders form such an important tool in the risk management arsenal of most households, we provide below some details about them as well as how they operate. [9]

Moneylenders in this region: They are typically local shopkeepers or traders, who provide loans in the form of cash as well as in-kind (mostly in the form of grains). Due to the nature of their relationships with borrowers, which normally involve repeated interactions over long periods of time, contract enforcement is reported not to be a problem. Informal interviews with villagers in Kashipur revealed that, after harvest time, moneylenders often collect loans in the form of cash crops by visiting the homes of their borrowers.

If a borrowing household is unable to return a loan, moneylenders sometimes employ them as unpaid agricultural labor (such as for grazing animals) or domestic labor or in more extreme cases, bonded laborers. The loan amounts ranged between 50 rupees (less than US$1, using an exchange rate of 1US$=70 Indian rupees) and 7,000 rupees (about US$100). The average loan

[9] The description of moneylenders and their activities is based on quantitative data collected as part of the grain bank surveys as well as qualitative data from group interviews conducted in both grain bank and non-grain bank villages in Kashipur, including ParajaSila, Telengiri, Similiguda, Ranjuguda, Patamanda and Bajansil.

size was 1,112 rupees (about US$16), with a standard deviation of 1,185 rupees (about US$17). The mean annual interest rate charged by moneylenders on outstanding cash loans (which formed 98 percent of outstanding loans) was reported to be close to 50 percent, with a standard deviation of 30 percent and a range of 5 percent to 250 percent.[10]

In this context, the NGO Agragamee started implementing its grain banks in the 1980s and 1990s. The main features of these grain banks are provided in a previous section. More details on both the intervention and the institution can be found in Bhattamishra (2012a).

Descriptive statistics of important village and household variables:

In this sub-section, we inspect the means of important village and grain bank variables.[11] We do this to examine if they indeed differ and whether any benefit may be obtained by constructing a "comparison" group comprising of only those households and individuals in NGBVs comparable to those in GBVs, rather than simply comparing all households and individuals across GBVs and NGBVs.

Table 6: Means of select village and grain bank variables, by village grain bank status

Variable	GBV (1)	NGBV (2)	GBV-NGBV (1)-(2)
Village-related continuous variables			
Distance from main road (km)	3.04	3.75	-0.71
Distance from block headquarters (km)	17.07	25.57	-8.50***
Time taken to travel to block headquarters by main mode of transport (minutes)	143.57	163.93	-20.36
Distance from closest Agragamee field office (km)	5.42	5.78	-0.36
Distance from the closest weekly market (km)	8.86	7.61	1.25
Distance from the closest post office (km)	3.14	3.64	-0.50
Total number of households	40.36	51.62	-11.26

[10] Given the flexibility and unwritten nature of these credit contracts, the interest rate figures reported above are unlikely to accurately take into account the value of in-kind payments (including unpaid household or farm labor in lieu of credit payments, pointing to interlinked labor-credit contracts), and are likely to be biased downwards.
[11] More details on basic living conditions of these communities are in Bhattamishra (2008).

Share of landless households	0.25	0.41	-0.16
Share of ST households	0.92	0.79	0.12
Share of households that have reported food inadequacy for at least 1 month in past year	0.55	0.74	-0.19
Grain bank-related variables (at inception)			
Grain bank household membership size	29.07	29.64	-0.57
Share of grains contributed by villages	0.23	0.14	0.09
Share of ST members in grain bank	0.86	0.83	0.03
Number of grain bank committee members	5.57	6.29	-0.72
Share of female grain bank committee members	0.47	0.43	0.04
Share of villages (in percent) having			
Functional primary school	42.86	71.43	-28.57
Midday meals at school	35.71	64.29	-28.58
Anganwadi center or sub-center	64.29	57.14	7.15
Regular (daily/weekly) visits by *Anganwadi* worker	21.43	7.14	14.29
Vaccination drive in last 5 years	42.86	21.43	21.43
Electrical connection	7.14	0.00	7.14
Tarred village road	14.29	7.14	7.15
New road in last 5 years	57.14	28.57	28.57
Walking as main mode of transport to block headquarters	71.43	64.29	7.14
Self-help groups	71.43	42.86	28.57
Village-level meetings on a need-basis	35.71	21.43	14.28
Ward member in last 5 years	64.29	64.29	0.00
Watershed management program in last 10 years	42.86	0.00	42.86***
Food-for-work program in last 10 years	71.43	71.43	0.00
Grain bank established prior to OHFSP [1]	71.43	54.55	16.88
N	14	14	--

Notes: Means for continuous grain bank-related variables for GBVs in (1) and for 11 villages where grain banks failed in (2). Shares for dichotomous variables for GBVs in (1) and 11 villages with failed grain banks and 3 where grain banks were never established (NGBVs) in (2). [1] Share in (2) does not reflect 3 villages where grain banks were never established.* Statistically significant at the 10 percent level; ** at the 5 percent level; and *** at the 1 percent level.

Section 5: Empirical methodology

Since grain banks were in operation when the study was conducted, experimental or difference-in-differences (DID) estimation was not possible. However, we wanted to do as rigorous an evaluation as possible to provide preliminary evidence and inform a discussion. In the absence of a valid IV or an allocation rule, we analyze the impact of grain banks using propensity score matching (PSM). We identify program effect by comparing the outcomes for children and households in GBVs with a comparison group of the same units in NGBVs constructed using PSM. Since matching is valid only under the assumption that selection into participation is based on observables, we designed the survey in order to capture all the measurable variables that may enter the decision process for participation.

We also choose matching over other non-experimental methods for the advantages the former offers. First, matching uses semi-parametric or non-parametric modelling which may give it some advantages over parametric non-experimental estimators. Second, it only compares units having "common support" and gives weights to observations differently depending on the distance in propensity scores between matched units. Third, and most importantly, we choose matching for our analysis as our data meet the conditions established for matching estimators to perform well relative to experimental estimates:[12] 1. a number of conditioning variables that potentially identify program placement, survival, participation and outcomes are available; 2. the same survey questionnaire is used in both grain bank- and non-grain bank villages as a result of which the outcomes of interest are measured identically, and 3. participants and non-participants are in the same geographical area, namely within the same administrative unit within Rayagada district in the state of Odisha, and face the same economic and ecological conditions.

Given that we use matching methods for our analysis, we choose the propensity score model carefully so that it includes a number of variables that affect both participation and outcomes based on theory, NGO consultations and the highest fit results using the 'leave-one-out cross-validation method' by comparing the model mean squared errors (MSE) (following Black and Smith 2004). We then employ kernel-weighted matching methods,

[12]See Heckman et al. 1997, 1998a; Heckman et al. 1998b, Diaz and Handa 2006.

since they are more efficient in a small sample such as ours and match a treated unit with the weighted average score of *all* untreated units within a short distance or bandwidth. We present results for the local linear estimator, which is a commonly used kernel-weighted estimator and converges at a faster rate at boundary points and adapts better to different data densities (Heckman et al. 1997). We choose the bandwidth which minimizes the MSE of our model, while enabling us to include a more inclusive *X* vector of balanced covariates. We only include comparison and treatment observations whose propensity scores fall within the region of "common support" (i.e., we include only comparable units), conduct basic balancing tests (i.e., ensure that treatment and comparison groups are statistically similar after matching) and test the sensitivity of the results to the "conditionality independence assumption" (CIA), i.e., the main assumption underlying matching that selection is on observable variables only, using a bounding approach (following Rosenbaum 2002).

Section 6: Empirical analysis and findings

In the next sub-sections, we examine food security and credit outcomes. Although grain banks are designed to address short-term food security concerns, they also affect long-term health and offer a credit alternative. In order to examine the impact on food security, we analyze the health outcomes for young children as we expect that nutritional inputs provided by grain banks should translate into improved health outcomes, and the impact of grain banks on them is likely to be more pronounced than on older children or adults. In particular, we examine children's *whz*-scores (a short-term indicator), their *haz*-scores (a long-term indicator) and their change in height (to capture underlying health due to seasonal food consumption fluctuations). In order to evaluate grain banks as credit alternatives, we examine their impact on borrowing from informal moneylenders in the agricultural lean season.

In tables 7a and 7b, we provide the estimates from the propensity score model for each outcome, as well as selected fit statistics including the MSE. In specifying the propensity score model, we include a number of variables that capture different aspects of household wealth, demographics, child and mother characteristics, which we consider to be important determinants of the outcome variable. We also include village-level variables which are likely to affect grain bank survival (thereby determining participation).

Table 7a: Determinants of grain bank participation estimated for creating propensity scores for food security outcomes

Dependent variable: Child in GBV household (1 = yes)			
	Estimated coefficients for outcome		
	(1)	(2)	(3)
	haz scores	*whz* scores	change in height
Household characteristics			
Social group (1=tribal)	0.0692	0.0957	0.0284
	(0.27)	(0.27)	(0.47)
Household size	0.353	0.321	0.295
	(0.34)	(0.35)	(0.48)
Square of household size	-0.0515*	-0.0531*	-0.0824**
	(0.027)	(0.028)	(0.041)
Number of children (14 years or less)	0.183	0.260	0.628**
	(0.17)	(0.18)	(0.25)
Number of adult females (15 years or more)	0.295	0.401	0.812**
	(0.25)	(0.25)	(0.33)
Low-lying fertile (bila) land owned (acres)	0.648***	0.611***	0.905***
	(0.18)	(0.18)	(0.24)
Low-lying fertile land, squared	-0.132***	-0.118***	-0.138**
	(0.043)	(0.041)	(0.054)
Semi-fertile (goda) land owned (acres)			0.253*
			(0.15)
Semi-fertile (goda) land owned, squared			-0.0561***
			(0.020)
Semi-fertile (goda) land owned (acres) – cubic term	-0.00283***	-0.00317***	
	(0.00089)	(0.0011)	
Infertile (dongar) upland owned (acres)	0.134	0.0774	0.416
	(0.15)	(0.15)	(0.28)
Infertile (dongar) upland, squared	-0.0557*	-0.0457*	-0.125*

	(0.029)	(0.027)	(0.064)
Gold holdings (gm)	0.0602***	0.0373	0.0269
	(0.023)	(0.024)	(0.032)
Floor quality (1 = pucca)	-0.175	-0.129	1.546**
	(0.39)	(0.39)	(0.64)
Number of ploughs owned	0.0215	-0.0360	
	(0.23)	(0.24)	
Number of crowbars owned	0.0682		0.294
	(0.15)		(0.19)
Number of spades owned	0.121	0.114	-0.203
	(0.12)	(0.12)	(0.15)
Number of sickles owned	0.157**	0.151**	0.350***
	(0.072)	(0.075)	(0.098)
Number of cows owned	-0.264***	-0.250***	-0.228**
	(0.061)	(0.063)	(0.093)
Number of bullocks owned	0.200	0.248*	
	(0.12)	(0.13)	
Number of goats owned	-0.0370	-0.0382	-0.172*
	(0.028)	(0.029)	(0.096)
Number of buffaloes owned	-0.484***	-0.410**	-1.088***
	(0.18)	(0.17)	
Mother's characteristics			
Mother's education (years)	0.0868	0.0683	0.00254
	(0.073)	(0.073)	(0.085)
Mother's height (cm)	0.00478	0.00646	0.0454***
	(0.014)	(0.014)	(0.017)
Mother's age (years)	-0.167*	-0.201*	-0.389***
	(0.10)	(0.10)	(0.15)
Square of mother's age	0.00273*	0.00323**	0.00602***
	(0.0016)	(0.0016)	(0.0023)

Child characteristics			
Child's age (months)	0.0104	0.00910	0.0163
	(0.014)	(0.014)	(0.024)
Child's age, squared	-0.000145	-0.000105	-0.000261
	(0.00020)	(0.00020)	(0.00030)
Child's sex (1 = male)	0.326**	0.348**	0.408*
	(0.15)	(0.15)	(0.22)
Community characteristics			
Distance from market (km)	0.0501***	0.0474***	0.0715***
	(0.014)	(0.014)	(0.020)
Distance from closest Agragamee field office (km)	0.00624	-0.00791	0.0177
	(0.048)	(0.048)	(0.070)
Distance from closest Agragamee field office (km), squared	-0.00133	-0.000620	-0.00213
	(0.0024)	(0.0024)	(0.0037)
Frequency of village meetings (1 = frequent/ as needed)	1.794***	1.741***	1.882***
	(0.20)	(0.20)	(0.30)
Constant	-2.799	-2.409	-6.619**
	(2.49)	(2.58)	(3.27)
N	430	409	279
Wald χ^2	194.97	182.44	120.28
p-value	0.0000	0.0000	0.0000
McFadden's Pseudo-R^2	0.3809	0.3656	0.4532

Notes: Pseudo-MLE probit regression estimates. Estimates corrected for sampling weights. Standard errors reported in parentheses.

*Statistically significant at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level.

Table 7b: Determinants of grain bank participation for propensity score estimation

(for analysis on borrowing from the private local moneylender)

Dependent variable**:** Grain bank member household (1 = yes)		
	Coefficients	(S.E)
Household human capital assets		
Household size	0.515	(0.32)
Square of household size	-0.0518*	(0.029)
Number of adult females (15 years or older)	-0.0931	(0.19)
Number of adult males (15 years or older)	-0.193	(0.19)
Age of head of household	0.00465	(0.013)
Highest level of education of any household member (years)	0.0514	(0.038)
Social group (1 = tribal)	0.431	(0.40)
Household physical assets		
Amount of fertile *(bila)* agricultural land (acres)	0.120	(0.14)
Amount of moderately fertile (*goda*) agricultural land (acres)	-0.216***	(0.077)
Amount of infertile (*dongar*) agricultural land (acres)	-0.205**	(0.10)
Amount of gold holdings (gm)	0.0659**	(0.032)
Number of rooms in dwelling	-0.248*	(0.15)
Flooring quality (1 = pucca)	0.487	(0.44)
Number of ploughs owned	0.0157	(0.28)
Number of spades owned	0.245*	(0.13)
Number of cows owned	-0.264***	(0.080)
Number of goats owned	0.00581	(0.035)
Number of bullocks owned	0.346**	(0.15)
Village-level variables		
Time taken to travel to seat of local government (minutes)	-0.0989***	(0.036)
Distance to closest Agragamee field office (km)	-0.00771***	(0.0012)

Village member elected as local political representative		
(1 = yes)	0.963***	(0.23)
Frequency of village meetings (1 = frequent)	0.0375	(0.24)
Constant	-0.409	(1.10)
Wald $\chi 2$		107.97
p-value		0.0000
McFadden's Pseudo-R2		0.2089
N		480

Notes: Pseudo-MLE logit regression estimates corrected for sampling weights.

* Statistically significant at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level.

After we generate propensity scores, we implement the common support restriction, so that the test of the balancing property is performed only on observations whose propensity score belongs to the intersection of the supports of the propensity score of treatment and comparison units. We find that the variables used in the specifications fulfil the balancing property criteria, using a range of tests including (1) *t*-tests for difference in covariate means between the matched treatment and comparison samples; (2) standardized bias before and after matching; and (3) pseudo-*R*-squared of the propensity score model after matching.

Table: Average treatment on the treated (ATT): Impact of grain bank participation on selected outcome (Local linear regression matching estimates using propensity scores)

	(1) *haz* scores		(2) *whz*-scores		(3) Change in height		(4) Incidence of borrowing (%)	
Average outcome, participants	-1.963		-1.712		0.052		0.223	
Average outcome, non-participants	-2.050		-1.577		0.045		0.332	
Difference in average outcomes (ATT)	0.087		-0.135		0.007		-0.099**	
	(0.228)		(0.189)		(0.009)			
	Off support	On support	Off support	On support	Off support	On support	Off support	On support
No. of treated units	16	176	11	172	39	74	0	249
No. of comparison units	0	236	0	226	0	166	39	211

Notes: Standard errors are provided in parentheses. Estimates generated using bandwidth size=0.06 for matched sample having common support only.

* Statistically significant at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

The table above presents matching estimates of the average impact of participation in grain banks on children's health and credit outcomes.[13] Although none of the estimates for grain bank impact on children's *haz*-score, *whz*-score nor change in height is statistically significant, the estimate for impact on the incidence of borrowing from moneylenders is. The incidence of borrowing from moneylenders by households in GBVs is 9 percentage points lower than by households in NGBVs. Translating this absolute difference into relative terms, the incidence of borrowing from moneylenders is about 29 percent lower for households in grain bank villages. We find that very few observations are off the common support, which implies that the larger program impact estimate compared to the naïve or unmatched difference is driven by the reweighting of households during matching. Using a bounding approach suggested by Rosenbaum (2002), we find that our the results continue to be significant even if there are departures from the identifying assumption underlying matching. However, this test can only provide greater confidence that our inference is not impaired by unobserved heterogeneity bias, as the CIA assumption itself is untestable and the small sample properties of the Rosenbaum bounding test are unknown.

Section 7: Summary and conclusion

In the past two decades, grain banks have been adopted by rural and tribal development NGOs in Odisha to combat food shortages, especially seasonal ones. By channeling household savings and providing credit to smooth consumption over the agricultural cycle, they have the potential to not only improve children's health in the short term but to also mitigate the long-term adverse impacts of seasonal malnutrition. However, propensity score matching estimators indicate no significant impacts of grain bank participation in ST Odisha on short-term or longer-term nutritional indicators, even during the agricultural lean season, when food shortages are at their most acute.

[13] We also estimate the ITT as it measures the impact for all households and children in GBVs, not just participants. ITT estimates take into account the fact that the researcher cannot fully capture the decision-making process of participants. Although this may be important as grain bank participation is voluntary, we posit that this is unlikely in our case as the vast majority of households in GBVs (94% in our data) do participate in grain banks. We find that our ITT estimates (not presented here) are indeed very similar to the ATT estimates.

Since grain banks also provide credit, we examine their impact on a non-food security outcome, in particular, borrowing from local moneylenders. Our hypothesis is that by providing an alternative source of credit, grain banks, which are community-based organizations, displace local moneylenders, who were traditionally the only source of consumption credit in this region. Using the same estimation strategy, we find that grain bank participation significantly reduces incidence of borrowing from moneylenders. Statistical tests using Rosenbaum bounds suggest that our estimates are robust to the potential presence of unobserved heterogeneity that affects both program participation and the outcome of interest. Thus, we can conclude that by providing an alternative credit and savings product, grain banks may be enhancing welfare, both by providing a lower-interest credit alternative and also staving off the threats of loss of collateral and bonded labor.

These findings (of no impact of grain bank participation on health outcomes, but positive impact on non-health outcomes) can be easily reconciled if one considers the poor sanitation environment in tribal Odisha. Recent work in India (see Spears 2012, Hammer and Spears 2013, Duh and Spears 2017) documents how improved sanitation is critical for improving health status. Although child height is usually considered a product of nutrition (with the occurrence of stunting linked to poor nutrition or malnutrition) and used as a standard outcome measure by economists to examine the impact of nutrition interventions, the medical and epidemiological literature has long-documented that the sanitation environment and behavior is a critical component of the relationship between nutrition and health. Thus, although grain banks may have potential, we may not be able to attain any positive impact on nutrition unless there are accompanying interventions that improve the sanitation environment and practices. Establishing standalone grain banks in order to promote food security may therefore be a futile endeavor.

Alternately, even if grain banks have a positive effect on some children's health, our results may not show it if the average treatment effect on the treated is heterogeneous across the treated units. Unfortunately, we are not able to estimate the treatment effect at different points or sections of the distribution due to sample size limitations. Therefore, our results, which are based on the entire distribution of households, may simply be disguising the fact that the average treatment effect varies over the distribution.

Also, parents may be acting as a buffer against volatility in consumption of their children in non-grain bank villages, thereby masking any effect that grain banks may have in reducing volatility in consumption and health outcomes of children. Although this can be tested by comparing consumption of adults in GBVs and NGBVs, we cannot in this study due to data limitations.

The estimates should be viewed essentially as preliminary explanations which can complement the evidence provided by practitioners active in the field (see Dreze 2018 for a discussion of the unique perspective that practitioners can offer). Such explanations can be useful for uncovering questions along the causal chain (e.g., why don't nutrition inputs translate into better health outputs?), implementation issues (e.g., what role does the implementation agency play in achieving institutional change? What are the missing links for enabling effective food security?), and participation (e.g., are there non-participants in grain banks in GBVs who continue to be food-insecure?).

Estimates from a larger follow-up study can enrich our understanding of grain bank impact and the communities they are based in. While the potential of grain bank-type institutions to address food insecurity in remote areas is apparent, evaluating such an institution is not simply an issue of evaluating the impact of borrowing grains; rather, the institutional support provided by the NGO to recipient communities is probably just as important. From an evaluation perspective, one solution to this problem is to randomize at the level of the community. Due to budgetary constraints, we could not do so here, but a future study with a larger scope may provide more rigorous evaluation results.

What are some of the main advantages from implementing a larger follow-up study to examine grain bank impact? First, implementing a baseline survey before establishing grain banks in target villages will permit DID estimation, which can address some of the concerns in using PSM, given the untestability of the CIA and little evidence on the small sample properties of the Rosenbaum bounds test. Second, data on a sufficiently large number of observations will permit estimation of the average treatment effect for different points or sections of the distribution, addressing the problem of heterogeneity. Third, survey data collection from target villages as part of a phased implementation of grain banks can provide experimental data. Fourth, data which enables the researcher to compare the cost-effectiveness and impact of grain

banks compared to other food security and financial market interventions can provide critical information on how best to allocate scarce resources. Given that the current government is in favor of moving towards cash subsidies, a comparison of the cost-effectiveness of grain bank in-kind grants or subsidies versus cash subsidies may also provide timely and useful information. Finally, long-term tracking which focusses on broader outcomes such as seasonal migration, distress sales of livestock and other productive assets, and the consumption of undesirable forest food products or other measures which can better capture hunger alleviation outcomes, would enrich our understanding on the potential of grain banks to act as the first line of defense in the war on hunger, in particular seasonal hunger, especially in remote regions. Perhaps more importantly, it can also highlight the problem of hunger and the need to examine innovative options, including new physical storage facilities and the use of a rainfall index to trigger flows into local grain reserves, to address hunger and seasonality in indigenous and remote areas.

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Appendix 1: Data: Sampling methodology

The main objective of the survey was to collect village, grain bank and household level data to implement an institutional and impact analysis of community grain banks in tribal Odisha, India. The data collection was undertaken in three phases. First, a household survey, accompanied by a village and grain bank survey, was conducted between January-March 2005 in 28 villages in Kashipur block, Rayagada district. Second, a village and grain bank survey was conducted between April-May 2005 in 80 villages in Dasmantapur block, Koraput district. (Koraput and Rayagada districts are adjoining.) Third, a second wave of the household survey, accompanied by a pared down version of the village and grain bank survey, was conducted in 26 of the 28 initially sampled villages in Kashipur, between August-October 2005.

A two-stage sampling design was adopted, whereby sample villages were selected first and sample households second. The sample frame of villages for the first round was drawn in consultation with Agragamee staff and management. Administrative divisions (locally called *gram panchayats*) experiencing unrest related to the establishment of the Utkal Alumina factory were excluded.[14] Villages that were practically inaccessible due to the rocky terrain or lack of communication facilities or were home to isolated primitive tribal groups (such as the *Dongaria Kandhas*) were also excluded. From the remaining 11 *gram panchayats*, two separate lists of villages were constructed after consultation with Agragamee field officials and office records. The two lists were villages with grain banks which were continuously operational since inception for at least 5 years (referred to as GBVs) and villages where grain banks stopped functioning at least 5 years prior to the survey (referred to as FGBVs). The two lists were constructed in order to allow the analysis of the impact of grain banks on health outcomes of children below the age of 5 years.

A list of all households (with the name of the household head) in these villages was drawn up. Within each of the selected villages, 20 households (or less, if the total number of households in a village was less than 20) were randomly selected. A total of 544 households were surveyed; 269 households were in grain bank villages (GBVs), and 275 were in non-grain bank villages (NGBVs).

The timing of the second wave corresponds with the agricultural lean season when food shortages are at their most critical. Twenty-six of the 28 villages surveyed in the previous

[14]This was done mainly due to safety considerations for the survey team. In addition, inhabitants of these areas experience issues that are distinct from adjoining areas where the grain bank survey was implemented, including conflict and violence, loss of agricultural land, environmental degradation, as well as potential increase in future employment and earnings opportunities.

round of the household survey, which corresponded to the agricultural harvest season, were re-surveyed.[15]

For the second wave of the household survey, a rotating panel sample design was adopted in order to balance the objectives of obtaining a large number of panel observations without reducing the sample size. This was performed keeping in mind that the survey was being conducted at a very critical time in the agricultural calendar. Since this was the sowing season, adult members of the household were likely to leave their village during the day to perform agricultural tasks in their fields.

Within each sample village, attempts were made to contact 15 out of the 20 sample households selected in the first wave and to contact 5 new households based on the original household listings. This was possible in all but 3 sample villages, where more new households had to be sampled due to the absence of more than 5 households from the previous wave. Households that could not be contacted had indeed left for agricultural tasks in spite of prior notification by the survey team.

A total of 516 households were sampled. Contact was reestablished with 400 households from the first wave, and 99 new households were added. This brought the total usable sample to 499 households; 250 households were in GBVs, and 249 in NGBVs. The response rate was close to 97 percent. Children's height, weight and mid-upper-arm circumference (MUAC) measurements were collected, as were data on food security perceptions and borrowing from the local moneylender, among other things.

[15] Two villages -Bhatipas and Gulmijholla - could not be surveyed due to flooding of the access bridge (in the former) and an outbreak of a cholera epidemic (in the latter).

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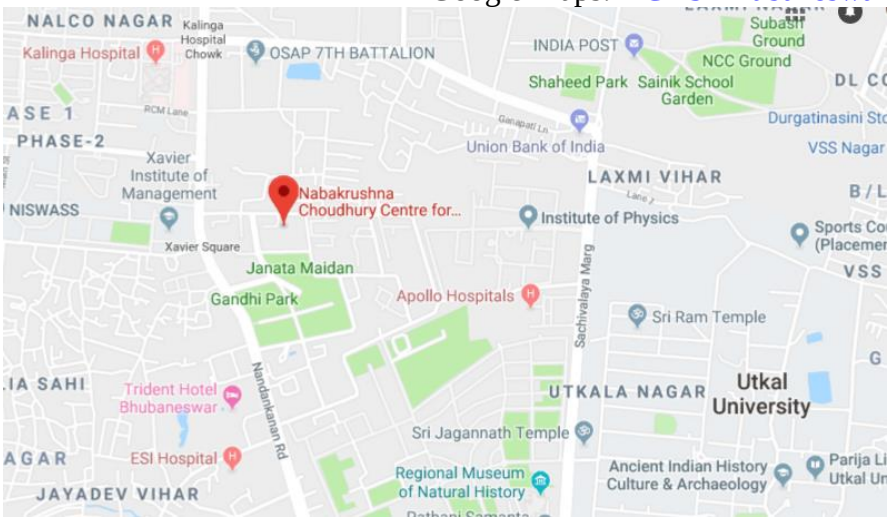

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