Reducing Corruption in Bihar's Public Distribution System

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June 21, 2018

Abstract

India spends 1 percent of its GDP on providing food at subsidized rates (one-tenth of the market rate) to the poor. However, since people often rely on the shopkeeper to inform them about the arrival of food-grains in the village, there is a significant scope for arbitrage and black-marketing. The main objective of the study is to estimate the prevalence of corruption in the Public Distribution System (PDS) in Bihar and examine possible mechanisms through which an information campaign can increase transparency. We randomize 175 villages in Bihar, a low-income setting in northern India, to receive an automated voice call a day after the food-grains have arrived at the shop. Findings suggest that relaxing household's information constraints might be one way to empower them and reduce corruption.

Keywords: Food subsidy, In-kind transfers, Corruption

JEL codes: D72, O12, N45

1 Transparency and Corruption

In kind-transfers are prevalent in both developed and developing countries. Public expenditures on select in-kind programs in health, housing, child care and education in some OECD countries is 10-15% of GDP (Gahvari and Currie 2008). In India, the government spends 3% on welfare programs. In-kind transfers are important both because of their total budgetary outlay as a proportion of the size of the economy and the areas/fields they are typically found in. These transfers though are a "leaky bucket" and there's a higher probability of elite capture when beneficiaries informationally constrained.

This paper considers the case of India's food subsidy program. India spends almost 1 percent of the GDP on providing food subsidy to the poor. This is India's largest welfare program in terms of sheer size of the budget and the number of people covered under it. Afterall, the recent National Food Security Act (NFSA), 2013 aims to cover 75 percent and 50 percent of rural and urban population respectively. However, a large number of studies have shown that the Government hasn't been able to develop a system that can effectively deliver the subsidized grains to the intended beneficiaries. In fact, the performance of this programme has been traditionally poor in the states with greater poverty. However, in the recent years, some of poorest states of India – Chhatisgarh, Odissa and Bihar – have undertaken a wide range of reforms to improve the functioning of the Public Distribution System (PDS).

As the Government mulls over whether to replace the current PDS with a cash transfer program, it's important to study the nature of reforms undertaken in these states and whether they are associated with lower level of leakages in PDS. This study aims to document the supply side reforms in Bihar's PDS and explain why or why not these changes have been effective. Broadly, we wish to answer the following questions:

1. What is the level of leakage in PDS after implementation of NFSA?

2. Is there any variation in the way the supply side reforms have been implemented and whether the areas with better implementation are associated with lower leakages?

3. Is there any effect of an information campaign – SMS alerts on foodgrain delivery to PDS and voice calls– on foodgrain leakages?

Bihar is one of the poorest states in the country and a well functioning subsidized food program with minimal leakage can act as a crucial safety net to the poor. Over the past few years, the state has undertaken several supply side reforms in the PDS that have the potential to substantially reduce leakages: computerization of supply chain, door step delivery using GPS enabled trucks, SMS alerts to beneficiaries and real time tracking of vehicle movement at Bihar State Food Corporation (BSFC) headquarters. This study will use existing supply tracking data from the BSFC to shed light on the status of NFSA implementation on ground and identify the processes and operational challenges that have the potential to lead to any leakages.

We collected primary data from PDS end-beneficiaries to estimate leakages in food grains. Most studies use an indirect and imprecise method of estimating the leakages in the PDS. The most commonly used measure is 'the proportion of grain released by Food Corporation of India (FCI) that does not reach households', which is calculated at state level by matching the off-take data from the FCI with the household purchases of PDS grain from the National Sample Survey (NSS). This method of estimation entails several approximations (such as a multiplier to aggregate per capita PDS purchase to the state level) and may not be always reliable as a small change in the assumptions/approximations may result in substantial difference in the estimates of leakages. For instance, the estimates of state level leakages by Gulati and Saini (2015) based on 2011-12 NSS data, which is also used in the report by High Level Committee on FCI reforms, show 68% leakages in PDS in Bihar. However, Dreze and Khera (2015), using the same data but with slightly different set of approximations find the leakages to be much lower at 24%. Secondly, this indirect method doesn't allow one to break-up the total leakages to identify the source of leakages (for instance, whether the leakage occurs before the grains arrive to the shop or whether they are being diverted after they arriving in the village).

A key drawback of conventional approaches to measuring corruption is that they are unable to account for supply-side bottlenecks. If there are genuine problems in the supply chain management and households do not receive their foodgrains, then all such cases will be considered as 'leakage', thus overestimating the actual corruption. We improve on previous research by addressing this concern; our approach relies on matching administrative information on the date of delivery of foodgrains in a village with household's self-reported answers. On the supply side, if we observe that grains were dispatched to a village and if, on the demand side,

households claim to have not received them then we classify such cases as 'leakages'. The advantage of this method is that it provides a precise estimate of corruption.

The study also aims to contribute to the policy debate on improving service delivery and explores whether an information campaign (via voice calls) can help promote greater monitoring of the system so that corruption might be reduced. To test the effectiveness of such measures, we conduct a randomized control trial with an aim to relaxing the informational constraints facing households. The role of information in reducing corruption and improving transparency has been experimented with but with little or no success in the Indian context.[1] We propose to provide people with actionable information about their food-grain entitlements as per a near universal subsidy program. India spends almost 1 percent of the GDP on providing food subsidy to the poor.[2] This is India's largest welfare program both in terms of the budgetary outlay and the number of people covered under it. Figure 2 and Figure 3 illustrates the performance of the public distribution system in Bihar.

The study speaks to three broad literatures: (1) role of information in monitoring welfare programs (Björkman and Svensson, 2009; Banerjee et al., 2010, 2016, 2017); (2) corruption Olken (2006, 2007); Olken and Pande (2012); Niehaus and Sukhtankar (2013) and clientelism Jeffrey (2002); Fujiwara and Wantchekon (2013); Anderson et al. (2015); and (3) performance of the public distribution system in India (Mooij, 2001; Nagavarapu and Sekhri, 2014; Choithani and Pritchard, 2015; Kishore and Chakrabarti, 2015; Dreze and Khera, 2015; Kumar et al., 2016; Nagavarapu and Sekhri, 2016; Chakrabarti et al., 2016; Pingali et al., 2017)

2   Design and Data

Context

The legal mandate (NFSA 2003) requires that all Public Distribution System (PDS) beneficiaries are entitled to receive 5 kg of rice and wheat per person every month.

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[1]Information campaigns have been conducted in the fields of education (community participation), health (HIV prevention, water chlorination, double-fortified salt) and elections (electoral accountability and monitoring)

[2]In 2016-17, budgetary estimates of welfare spending at Ministry of Consumer Affairs, Food and Public Distribution were INR 134,915 crore and GDP (at current prices) during the same period was INR 15,251,000 crore. Source: `http://mospi.nic.in/sites/default/files/press_release/nad_pr_28feb17r.pdf`

Grains are provided at subsidized prices of Rs 2 per kg (for wheat) and Rs 3 per kg (for rice). At current market prices, the subsidy to consumer reduces food prices by approx. 90 percent. The procurement and distribution of grains at the national level is managed by Food Corporation of India (FCI). The FCI had storage silos across the country and are responsible for transferring the stock of food grain to various State Food and Civil Supplies Corporations (SFC), who in turn have to ensure that it reaches the PDS shop keepers (also called 'Fair Price Shops/FPS') from where eligible families can claim their entitlements. Thus, the distribution system is: FCI > SFC > FPS > eligible households. Before NFSA, a targeted approach to identification of PDS beneficiaries was adopted but after NFSA 2013, there is a near universalization of subsidy. In Bihar, over 80 percent of the population is eligible for the subsidized food.

At the cornerstone of the entire process is the FPS (and by analogy the PDS shopkeeper, also referred to as the 'dealer'). There are over 40,000 FPS in Bihar (Figure 1a) and each caters to around 400 households. FPS have a monopoly over a set of households and beneficiaries may only purchase grains from their assigned shopkeeper. Figure A2 provides an overview of the functioning of the system. After the grains arrive at SFC, they are allocated to districts then to blocks (sub-districts) and finally to FPS, when an 'e-Challan' (a kind of bank payment voucher) is generated. PDS shopkeepers are then required to take print-out of the voucher and visit a the bank, where the requisite payment (as stated in the e-challan) is to be made. Once the payment is reconciled at the backend, by the bank/district officials, a store issue order (SIO) is automatically generated. When a SIO is successfully generated, it signals that foodgrains are ready to be dispatched. The grains then leave the storage facilities (at the block/sub-district level) for the FPS and once they are delivered at the shop, a data entry operator uploads the delivery details on a publicly accessible website (including the date, time of dispatch, truck number and driver's name).

Design

A primary objective of the baseline survey was to measure the extent of 'leakage' in the public distribution system in Bihar and in order to do so, the following research design was adopted:

- *Information areas*: The survey covered topics of food security, ration history, purchase experience at Fair Price Shops (FPS), financial inclusion and socio-economic and demographic information.

- *Geographical coverage*: The survey was conducted in the districts of Gaya, Munger, Saharsa and Sitamarhi. Exploratory research was conducted in Araria and Muzaffarpur districts.

- *Period of survey*: The survey was conducted over 2 months, between December 2016 and January 2017. In each month, two districts were covered and an equal number of primary sampling units (PSUs) were allotted to ensure uniform spread over the survey period

- *Schedules of enquiry*: Two structured questionnaires were fielded during the survey and these are as follows

  - Household schedule to capture individual level data
  - Village schedule to collect community level information

- *Sample design*: A two stage stratified sampling design was adopted for the survey. In the first stage, four districts were randomly selected from each of the four zones of Bihar (Sitamarhi from Tirhut zone, Saharsa from Kosi zone, Gaya from Magadh zone and Munger from the Bhagalpur zone) to guarantee wide geographical spread. Within each district, five blocks (four primary blocks and one replacement block) were randomly chosen. In the second stage, FPS were randomly selected using probability proportional to size (PPS) sampling, where size was defined as the total number of beneficiary households in FPS. The PSU was a village and a 1:1 mapping between FPS and village was ensured by selecting the largest village in case of multiple FPS (and vice versa). Finally, a sample of 30 households (20 primary and 10 replacement households) was randomly chosen within each FPS.

- *Sampling frame*: The Socio-Economic Caste Census 2011 data was used as the sampling frame for the study.

- *Sample size*: A total of 5,000 households in 250 FPS was the allocated/planned sample size of the study. The achieved sample size was 5,097 households across 255 FPS.

- *Sample estimation*: The assumptions for the calculation of 250 clusters/FPS was as follows:

  - Confidence level/alpha: 0.05
  - Power/beta: 0.8

– Intra-cluster correlation/rho: 0.33

– Minimum detectable effect/delta: 0.22

- *Representativeness of study*: The findings of the study are representative for all priority households (PHH) in rural and semi-urban Bihar. The study neither included AAY households nor conducted any survey in urban towns or district headquarters.

3   Empirical Strategy

In addition to documenting the status of PDS in Bihar after implementation of the NFSA, the study also aimed to examine the mechanisms through which an information campaign can increase transparency. While the role of information in reducing corruption is well established in the literature, the exact pathways through which the impact occurs is an open question. We initially proposed to conduct a two-stage cluster randomized trial to shed light on this question and the proposed study was to be conducted across 250 shops in 4 districts in Bihar. In each village/shop, 20 households were proposed to be interviewed. Beneficiaries would have received two set of voice calls:

- First call:

  – Randomized at the shop level: half of the shops would be assigned to treatment, while the remaining half would be control. Within treatment shops, randomly selected 15 (out of 20) households would receive voice calls informing them about the date of arrival of grains in their village. The five additional households would provide information on within-shop spillovers.

  – Randomly assigning the first call would, thus, would help estimate the 'monitoring effect'.

- Second call:

  – A random subset of households under the treatment shops were to get a second voice call

  – The second call intended to provide information about what beneficiaries should do if they do not receive their entitlements. By randomizing information about a grievance redressal mechanism, comparing individu-

als who did not receive the second call would have helped estimate the 'recourse effect'.

Unfortunately, due to budget constraints and unforeseen circumstances, only the first part of the intervention could be successfully executed. In addition, discrepancies between the sampling frame and the ground-realities meant that there were sampling clusters (villages) where sampled respondents were being catered by multiple shopkeepers. From time to time, licenses of shopkeepers are suspended/canceled and beneficiaries assigned to neighboring shopkeepers. This complicated the research design of the study and consequently only 175 clusters (instead of 250) were available for the field experiment. Thus, the findings of the study are limited to only estimating the treatment effect of the 'first call' that was aimed at relaxing the information constraints for the households. (Findings of the baseline survey suggests that there is considerable delay in delivery of grains to the shop and that beneficiaries do not seem to have a reliable way of finding out about arrival of grains; see below).

4 Results

4.1 Findings from baseline survey

- *Food Security*: Food security is a critical issue and 36 percent of the households reported that there was at least one family member has gone hungry in the last 30 days due to lack of food. Majority households (76 percent) have either sometimes or often worried that they do not have enough food during the month before the survey. (Figure 4)

- *Scenario before 2013*: In light of the above, the role of PDS cannot be overstated. Before NFSA was enacted, there were multiple issues in identification of beneficiaries and targeted PDS in Bihar had more than 75 percent leakage/diversion with a majority of it occurring at the Fair Price Shop (FPS) level, as per a study by Planning Commission (PEO-Government of India, 2005)

- *Present Status*: As discussed earlier, the conventional approach to measure leakage in PDS is likely to overestimates leakage because it relies on offtake or allocation data that might be different from foodgrains actually delivered to FPS (Figure 1b). Using a sophisticated approach which compares dates of ration delivery with self-reported household data, we estimate that the percentage of

households who did not receive ration was 36 percent in October 2016. Thus, leakage has reduced after the government implemented a variety of supply side reforms such as computerization, door-step delivery, GPS tracking, inventory management and development of a modern MIS.

- *Types of Leakages*: Leakages in PDS have the following distinct dimensions:

  - **Month skipping**: 67 percent households report that they do not receive ration on monthly basis regularly throughout the year. On average, in one year, households reported not receiving ration for 4 months. (Figure 5d)

  - **Underselling**: 66 percent of households reported receiving less quantity than their entitlements. The average entitlement was 28.1 kg; average ration received (in October 2016) was 25.6 kg, implying that on average 2.5 kg of ration is not received by households. These estimates are calculated using self-reported family size. Using SECC reported family size, the proportion of households reporting 'underselling' is 59 percent

  - **Overpricing**: 52 percent of households reported paying more than they ought to for their entitlements. The average total price paid was Rs. 93.5 when in fact the average co-pay price should have been Rs. 67.1. This implies that on average households pay an additional 40 percent or Rs. 26.2 out of pocket.

- *Variation in Leakages*: Findings of the study also suggest that variation in leakage across FPS is almost equal to that observed within the same FPS. Beneficiaries do not seem to have a reliable way of finding out about arrival of grains as 90 percent of them rely on the dealer or other villagers for this information. (Figure 5b)

- *Cash Transfers*: It was observed that respondents who reported receiving ration regularly preferred PDS over cash transfer and vice versa. (Figure 6a and Figure 6b)

- *Financial Inclusion*: 99 percent of the household have AADHAR, 90 percent of the households have a bank account and 25 percent have an ATM card. The bank is, on average, 3.5 km away from home; 87 percent of the households reported that it took them one hour or less to reach the bank and once in the bank, it took respondents considerable time to withdraw money from their account.

- *Grievance Redressal*: Despite only one in three households (37.6 percent) reported being satisfied or very satisfied with PDS, a majority do not do anything to raise concerns. One in six households (16.8 percent) reported that someone in their village ever protested against dealer or lodged formal complaint but in most of the cases, no action was taken.

4.2   Voice call experiment

In order to study whether an information campaign can improve participation in a food subsidy program and reduce leakages, we randomly assign 90 out of 175 villages to an intervention where an automated voice call was sent to beneficiaries the day after foodgrains had been dispatched for their village. The call was pre-recorded in the local dialect and in Hindi, in a male voice. The transcript read: "Greetings! We would like to inform you that your rice and wheat entitlement for the month of X has arrived at your ration shop. To collect it, please contact your dealer. Issued in public interest using information from Bihar government's website sfc.bihar.gov.in. Thank you." The total duration of the call (for both languages) was under 1 minute. If the respondent did not answer the call first time, a maximum of 10 retries were attempted. Calls were sent daily between 8 AM and 8 PM based on the delivery dates that were reported by Government of Bihar's Department of Food and Consumer Protection, the nodal agency to coordinate the procurement and distribution of foodgrains for the PDS in Bihar. Over the course of the intervention (which started in April 2017 and ended in August 2017), nearly 170,000 calls were attempted with a success rate of 16 percent. A few novel aspects of the intervention were as follows:

- Medium: voice calls in local dialect (instead of English/Hindi text messages)

- Nature of information: actionable, not inert (nudging respondents to visit FPS and demand their entitlements)

- Measurement: monthly follow ups via a phone survey were planned (to reduce recall bias)

We first begin by conducting a 'balance check' on 15 key covariates in Table 2. We include: (a) household characteristics such as household size, highest education level of any member in the family, whether a household is landless and the number of migrants in a family; (b) factors affecting subsidized grains purchase behavior such as whether FPS is within village or not, the time taken to travel to the shop and procure grains from there, whether household is self-reliant on rice and

10

wheat via own home production, whether household depends on the shopkeeper to be informed about the arrival of grains in the village and whether the caste group of the household is aligned with that of the dealer; (c) multiple measures of leakages such as the number of months in past year that shopkeeper did not sell ration to the household ('skipping'), level of dissatisfaction with the PDS, whether household reporting not receiving ration in the months of October 2016 and November 2016 despite administrative data showing otherwise and the total amount of grains purchased by the household in two months prior to the survey. The household characteristics cover the most important factors impacting socio-economic conditions of poor households in rural Bihar and along with the FPS related factors these are likely to cover the majority of the observables that could impact households purchase experience. We note that none of the baseline characteristics are different across treatment and control villages. A F-test of joint significance of the 13 covariates (which have a similar sample size/N=3387) also suggests that we should not reject the null that treatment and control villages are similar to each other (p value = 0.884).

Before analyzing the data, we first check whether households actually received the call. Table 3 shows that the the probability of households assigned to the treatment was around one half. (Since households in the control villages did not receive the calls the probability was zero). Of the households who answered the call, the median duration of the call was almost for the entire duration of the call. A 50 percent strike rate implies that the 'treatment intensity' in the village would be around 15 percent (see Table **??**). Table 4 reports the impact of the intervention on three key outcome variables: (a) whether household reported receiving ration or not; (b) total quantity purchase (in kg); and (c) total price paid (in Rs). The first measure, (a), captures the extensive margin of corruption, while the latter two, (b) and (c), capture the intensive margin. It should also be stressed that the 'ration received' measure is suggestive of corruption because respondents were only interviewed in the follow-up survey, a day after food grains were dispatched to their village. In interpreting these estimates, it is also important to keep in mind that the voice calls only provided information about the delivery of grains (and not amount of entitlements or the co-pay price[3]). Col (1), (3) and (5) pool the data across different rounds of follow-up surveys, whereas Col (2), (4) and (6) add month fixed effects to the regressions. This table reports the aggregated intent-to-treat estimates: households in treatment villages were less likely to receive their entitlements by nearly 2 points, but the difference

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[3]Baseline data suggests that villages have high levels of awareness of the amount of grains they are entitled to

between treatment and control is not statistically significant. We do not find any impact of the intervention on both the extensive and intensive margins of corruption. In Table 5, we disaggregate the impact in intervention villages by looking at treatment and control-within-treatment households separately. Although none of the estimates are statistically significant at conventional levels, the point estimates in three out of the five months is negative, suggesting that corruption increase by around 8 points (approx 13 percent of the control group mean) in these periods. Given the low take-up rate of the intervention, we also estimate the treatment-on-treated effect by instrumenting whether the household actually received the call by their assigned treatment status. The IV estimates in Table 6 are slightly larger than the ITT estimates in the previous table. While one should be careful in not reading too much into these estimates, the overall negative point estimate (pooling across months) and the temporal pattern of the point estimating, switching back and forth between positive and negative, raise many questions. Did the intervention make household worse off? But how can providing more information *increase* corruption? One argument advanced in the literature relates to the dynamic trade-offs: corruption may increase if future rents are threatened (Niehaus and Sukhtankar, 2013). In the first month when the informational constraint was relaxed and households, presumably, went to the PDS shopkeeper to demand their entitlements, they were likely to be turned back since the PDS shopkeeper, having caught by surprise, would seek to double down on this claim that the grains have not arrived. The PDS shopkeeper's reputation is key as he is main source of information dissemination of food grain arrivals. The constant sea-sawing of the estimate could also suggest that the PDS shopkeeper is trying to learn about this new alternative private source of information in the village. If we believe that the voice calls were credible with the potential of increasing the villager's bargaining power and upsetting the power dynamics in the village then a corrupt shopkeeper's best response should be a mixed strategy as he tries to cement his credibility and learn more about this new system. As mentioned earlier, the primary objective of the study was to provide a reliable estimate of corruption at the state level; the field experiment was designed as an add-on to pilot test the technology that could be used to disseminate information at a wider scale. In future work, we plan to study some of these issues in greater detail.

5   Discussion

The findings of the study suggest that relaxing information constraints for households could have an impact to reduce corruption. It is imperative that a multi-

pronged strategy is adopted to reduce leakages in Bihar's PDS:

- List of PDS beneficiaries (tagged with FPS along with dealer's mobile number) should be made public and accessible on SFC/FCP website.

- An independent channel of communication with the end beneficiaries should be established so that relevant information can be provided to them directly.

- Use of Information and Communications Technology should be furthered and it must be ensured that design is suited to the context. For example, automated voice calls to beneficiaries in their local dialect (Angika/Maithili/Bhojpuri/Magahi) informing them about arrival of foodgrains would be helpful.

- The grievance redressal mechanism should be reinvigorated so that the process of registering complaints can be facilitated and beneficiaries can in turn be empowered.

- Policy decision to transition to a cash-based direct beneficiary transfer (DBT) model should also consider the 'transaction costs' imposed on banks and beneficiaries as accessing banking service is a time-consuming process.

- Receive feedback on a regular basis for making concurrent evaluation and policy changes.
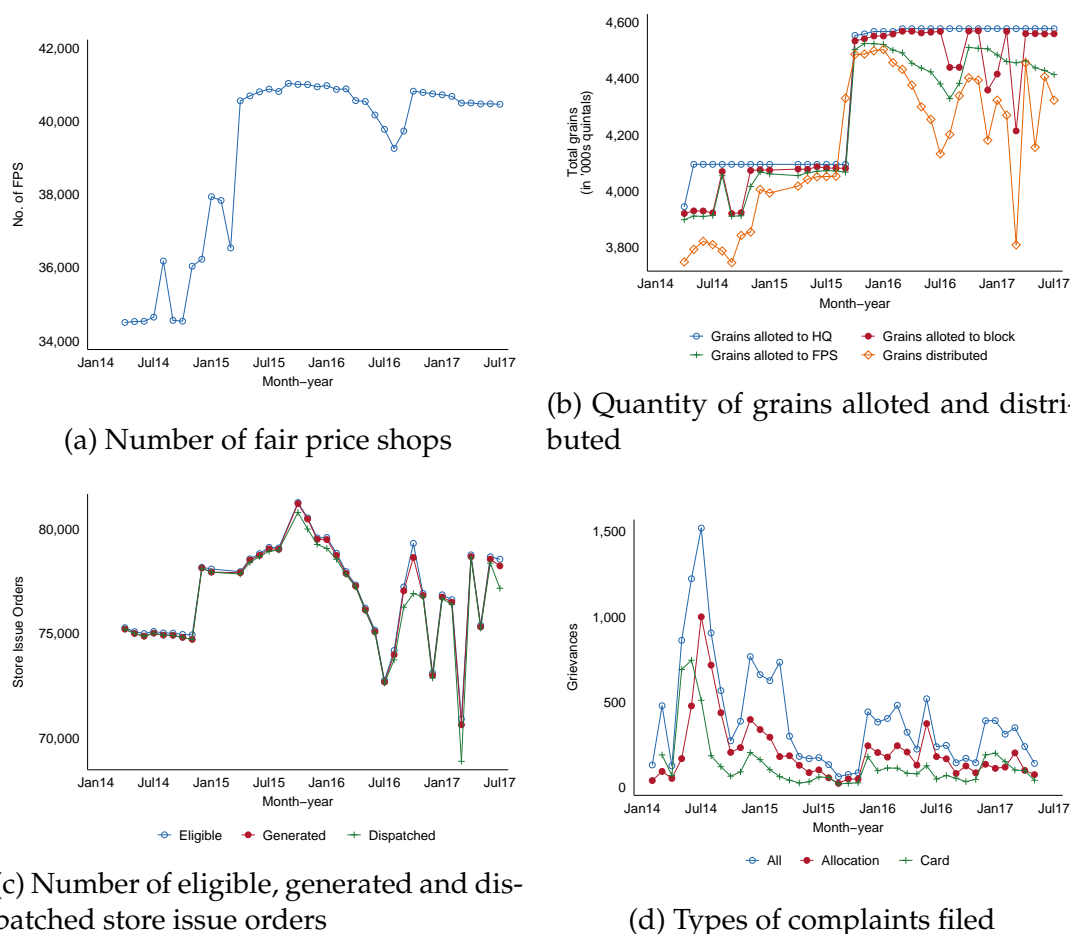
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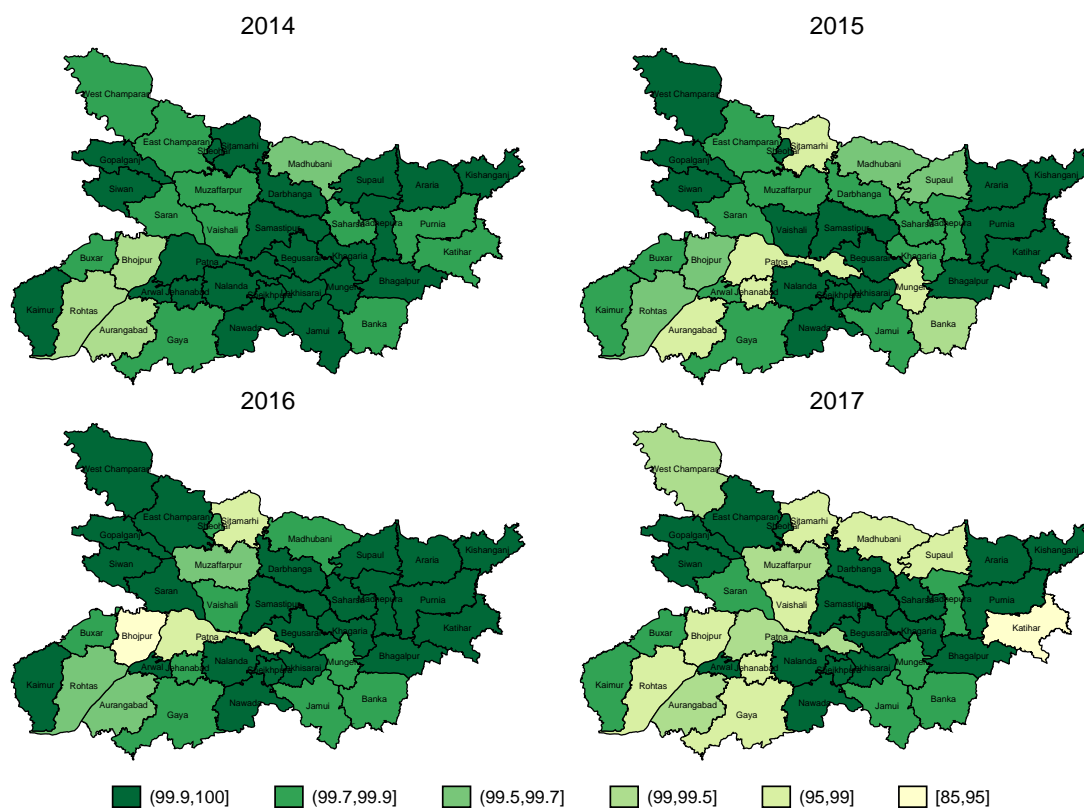
A   Figures

Figure 1: Overview of fair price shops in Bihar

(a) Number of fair price shops

(b) Quantity of grains alloted and distributed

(c) Number of eligible, generated and dispatched store issue orders


(d) Types of complaints filed

Note: Data from April 2014 to July 2017 for all districts in Bihar, excluding February 2015 and March 2015. (a) illustrates the number of fair price shops reporting data in the MIS. (b) shows the variation in the number of grains allocated and distributed. Units are in thousands of quintals. (c) illustrates the total number of store issue orders generated. Overall, 3,068,458 SIOs were eligible out of which 3,062,367 were generated and 3,053,279 were delivered. (d) illustrates the various types of complaints filed. There are 15,921 grievances between February 2014 and May 2017. The top three complaints were related to: allocation issues (51.45 percent), card issues (32.81 percent) and procurement issues (9.58 percent). Allocation issues refer to unfair practices by dealers such as not distributing grains or withholding part of the entitlement, overcharging, demanding extra coupons. Card issues refer to issues arising because beneficiaries were not issued ration cards or their names were not included in the list/card.

16

Figure 2: Store issue orders dispatched, by district and year (in percent)

Note: Data for 2014 for April to December; data for 2015 and 2016 are from January to December; and data for 2017 are from January to July.

Figure 3: Complaints filed, by district and year
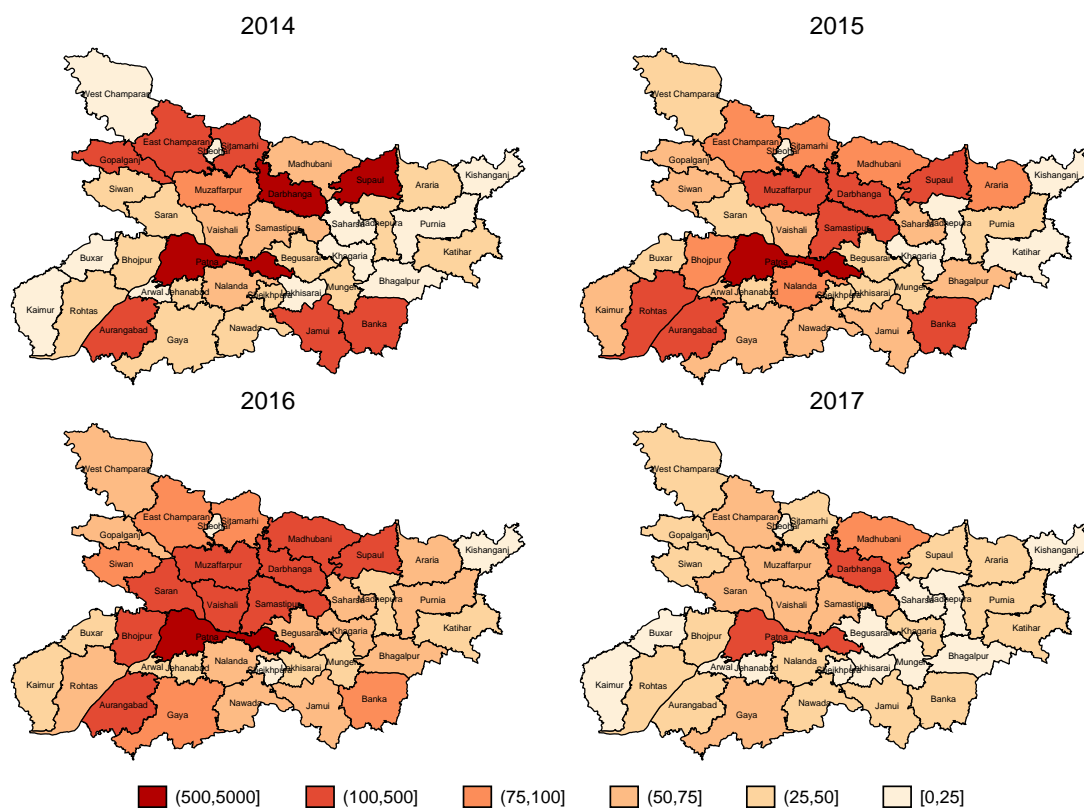

Note: Data for 2014 for February to December; data for 2015 and 2016 are from January to December; and data for 2017 are from January to May.

Figure 4: Food security
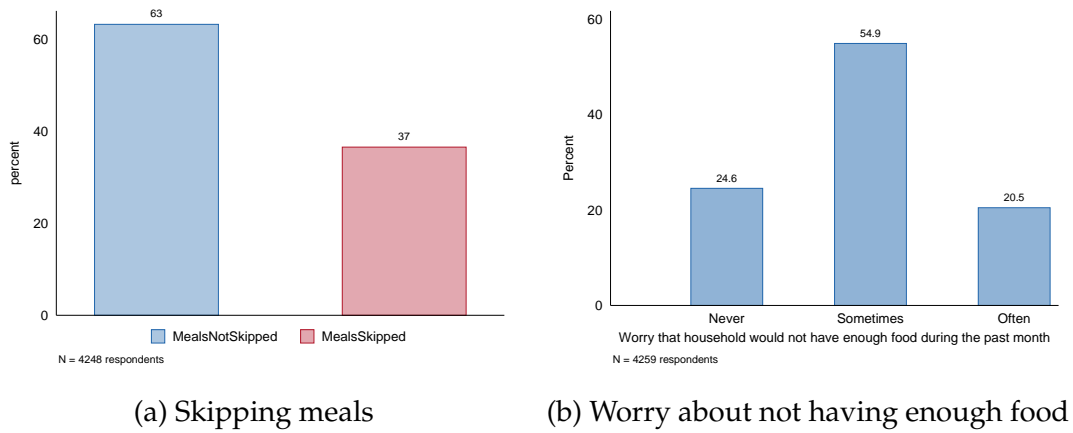
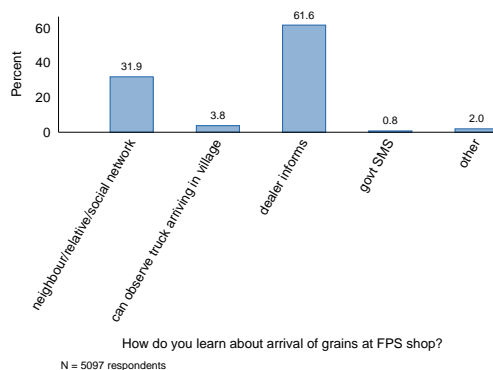(a) Skipping meals

(b) Worry about not having enough food

Note: Figure presents responses from the baseline survey conducted in four districts in Bihar. It illustrates that food security continues to remain a challenge.

Figure 5: Responses from baseline survey
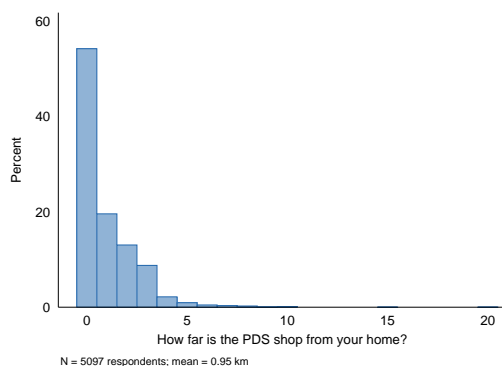
(a) Distance to shop

(b) Monitoring arrival of grains
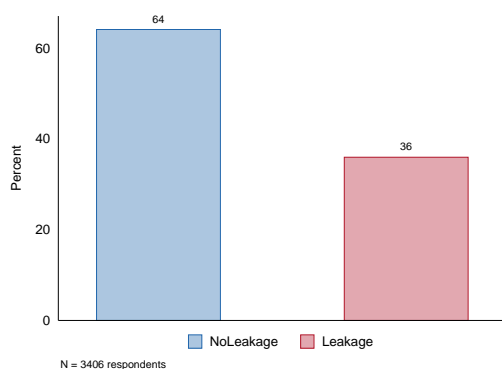
(c) Estimate of leakage (via ground truthing)
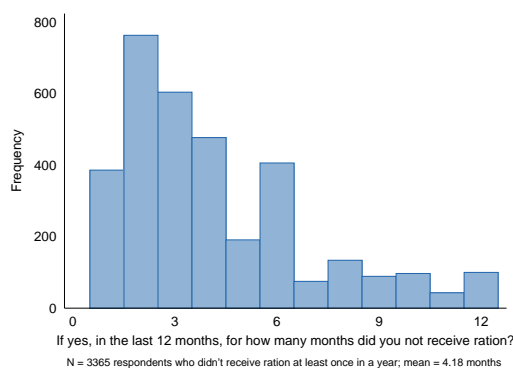
(d) Extent of leakage

Note: Figure presents responses from the baseline survey conducted in four districts in Bihar. It illustrates that respondents have an information constraint and that there is 'leakage' in the public distribution system.

Figure 6: Preferences for cash transfers

(a) No leakage/skipping

(b) Some leakage/skipping
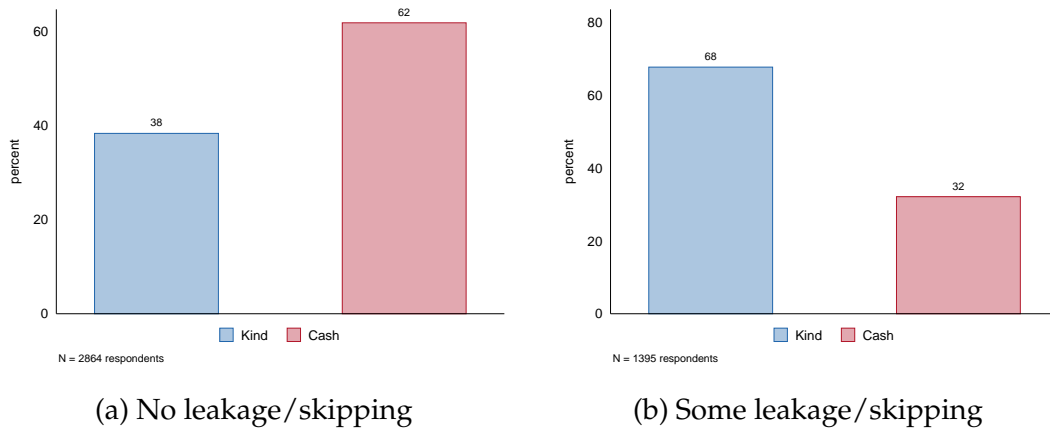
Note: Figure shows that respondents who reported receiving ration regularly preferred in-kind transfers over cash transfer and vice versa.

B Tables

Table 1: Distribution of Fair Price Shops (FPS) in Bihar, by district

District	No. of FPS	District	No. of FPS
Araria	1,398	Madhubani	1,754
Arwal	393	Munger	658
Aurangabad	1,398	Muzaffarpur	2,433
Banka	960	Nalanda	1,339
Begusarai	1,159	Nawada	989
Bhagalpur	1,296	Pashchim/West Champaran	2,066
Bhojpur	1,431	Patna	3,113
Buxar	857	Purba/East Champaran	2,509
Darbhanga	1,487	Purnia	1,250
Gaya	2,291	Rohtas	1,182
Gopalganj	1,332	Saharsa	797
Jamui	811	Samastipur	1,579
Jehanabad	618	Saran	2,760
Kaimur (Bhabua)	644	Sheikhpura	373
Katihar	1,136	Sheohar	349
Khagaria	689	Sitamarhi	1,175
Kishanganj	756	Siwan	1,612
Lakhisarai	444	Supaul	800
Madhepura	687	Vaishali	1,664
Total	19,787	Total	28,402

Note: There are a total of 48,189 FPS in Bihar.

Table 2: Covariate balance

Variable	(1) Control N/[Clusters]	(1) Control Mean/SE	(2) Treatment N/[Clusters]	(2) Treatment Mean/SE	T-test P-value (1)-(2)
Household size	1643 [86]	5.589 (0.091)	1763 [90]	5.642 (0.087)	0.678
Education level	1643 [86]	3.945 (0.084)	1763 [90]	4.094 (0.086)	0.216
1(Landless)	1643 [86]	0.539 (0.026)	1763 [90]	0.517 (0.021)	0.503
No. of migrants	1639 [86]	0.719 (0.029)	1761 [90]	0.721 (0.027)	0.951
1(Shop in village)	1643 [86]	0.602 (0.037)	1763 [90]	0.539 (0.039)	0.244
Ln(Travel+Waiting Time)	1643 [86]	4.154 (0.050)	1763 [90]	4.271 (0.051)	0.102
1(Grow rice and wheat)	1643 [86]	0.374 (0.025)	1763 [90]	0.397 (0.024)	0.497
1(Dependent on shopkeeper for info)	1643 [86]	0.607 (0.027)	1763 [90]	0.581 (0.024)	0.464
1(Caste group aligned)	1643 [86]	0.226 (0.021)	1763 [90]	0.258 (0.025)	0.339
No. of months skipped	1638 [86]	2.637 (0.206)	1757 [90]	2.787 (0.187)	0.591
Dissatisfaction	1642 [86]	2.788 (0.057)	1762 [90]	2.906 (0.059)	0.153
1(Leakage Oct)	1643 [86]	0.344 (0.035)	1763 [90]	0.374 (0.035)	0.539
1(Leakage Nov)	1643 [86]	0.262 (0.039)	1763 [90]	0.226 (0.033)	0.486
Grain purchases (Oct)	959 [85]	25.480 (0.493)	1046 [90]	25.919 (0.554)	0.554
Grain purchases (Nov)	1131 [85]	25.688 (0.471)	1168 [90]	25.991 (0.550)	0.675

Note: Table 2 shows that treatment and control are balanced across multiple covariates. Household size refers to the number of family members in sampled household; Education level refers to the highest grade that any household member has completed; 1(Landless) is an indicator variable for whether the household owns no land; No. of migrants refers to the number of family members migrating from household; 1(Shop in village) is an indicator whether the FPS/PDS shop is in the respondent's village; Ln(Travel+Waiting Time) is the natural log of the total time taken to purchase one's entitlements at the FPS; 1(Grow rice and wheat) is an indicator variable whether household (or their sharecropper) grown their own wheat and rice; 1(Dependent on shopkeeper for info) is an indicator variable for whether household relies on shopkeeper to inform them about the arrival of foodgrains in their village; 1(Caste group aligned) is an indicator variable for whether household's caste group matches that of the shopkeeper; No. of months skipped is the self-reported measure of leakage i.e. how many months in the past one year did household not receive ration; Dissatisfaction is a rating on a 5-point Likert scale of household's dissatisfaction with FPS shopkeeper (1=very satisfied...5=very dissatisfied); 1(Leakage Oct/Nov) refers to the measure of leakage calculated after accounting for supply-side bottlenecks in the months of October 2016 and November 2016 respectively; and Grain purchases (Oct/Nov) are the amount of grains purchased (in kg) n the months of October 2016 and November 2016 respectively. The value displayed for t-tests are p-values. Standard errors, in parentheses, are clustered at the village/shop level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Probability of receiving calls

	(1) Apr	(2) May	(3) Jun	(4) Jul	(5) Aug
Treatment	0.498	0.526	0.400	0.474	0.497
	(0.034)***	(0.030)***	(0.035)***	(0.031)***	(0.029)***
N	3,403	3,403	3,403	3,403	3,403
Control group mean	0	0	0	0	0
Call duration	68	69	67	68	67.5

Note: The dependent variable is a dummy variable for whether the household received the voice call or not. All households in intervention villages were sent voice calls (except those in the spillover group) but probability of answering the call could vary. Standard errors, in parentheses, are clustered at the village/shop level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Impact of voice calls on leakage

	Received Ration		Quantity received		Price paid	
	(1)	(2)	(3)	(4)	(5)	(6)
Intervention	−0.019	−0.018	0.532	0.551	1.553	1.590
	(0.035)	(0.035)	(0.777)	(0.773)	(3.772)	(3.759)
N	7,118	7,118	4,190	4,190	4,255	4,255
Month FE	No	Yes	No	Yes	No	Yes
No of villages	157	157	156	156	157	157
Control group mean	.63	.63	28	28	101	101

Note: Received ration is an indicator variable that denotes that household received their entitlement of foodgrains, after it was delivered in the village. Quantity received refers to the total amount of foodgrains (rice+wheat) that the household reported purchasing (in kg). Price paid is the total co-pay price paid by the household (in Rs.). Intervention is an indicator variable that is 1 if the household was in an intervention village (this includes spillover households). Col (1), (3) and (5) pool the entire data across all months; month fixed effects are added in col (2), col (4) and col (5). Standard errors, in parentheses, are clustered at the village/shop level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Intent to treat estimates of impact of voice calls on corruption

	(1) Apr	(2) May	(3) Jun	(4) Jul	(5) Aug
Treatment	−0.081	0.034	−0.079	0.020	−0.075
	(0.087)	(0.051)	(0.052)+	(0.060)	(0.106)
Spillover	−0.059	0.039	−0.047	0.030	−0.161
	(0.102)	(0.063)	(0.061)	(0.068)	(0.112)
N	677	2,310	1,776	1,736	580
No of villages	83	152	138	141	56
Control group mean	.63	.61	.64	.62	.69

Note: Received ration is an indicator variable that denotes that household received their entitlement of foodgrains, after it was delivered in the village. Treatment is an indicator variable that is 1 if the household in the intervention village and supposed to receive the voice call; spillover is an indicator variable that is 1 if household is a control-with-interventional household; the reference category is the 'pure control' group. Standard errors, in parentheses, are clustered at the village/shop level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Treatment on treated estimates of impact of voice calls on corruption

	(1) Apr	(2) May	(3) Jun	(4) Jul	(5) Aug
Received call	−0.135	0.048	−0.141	0.033	−0.129
	(0.149)	(0.076)	(0.090)+	(0.100)	(0.176)
Spillover	−0.059	0.037	−0.047	0.030	−0.163
	(0.101)	(0.063)	(0.061)	(0.068)	(0.111)+
N	677	2,308	1,776	1,736	579
No of villages	83	152	138	141	56
Control group mean	.63	.61	.64	.62	.69
First stage F-stat	91	753	199	338	134

Note: Received ration is an indicator variable that denotes that household received their entitlement of foodgrains, after it was delivered in the village. Received call is an indicator variable that is 1 if the household in the intervention village actually answered the phone/heard the call; spillover is an indicator variable that is 1 if household is a control-with-interventional household; the reference category is the 'pure control' group. TOT estimates are calculated by instrumenting received call by the treatment status. Standard errors, in parentheses, are clustered at the village/shop level. + $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C   Appendix

C.1   Welfare spending in India

Figure A1: Allocation of welfare schemes
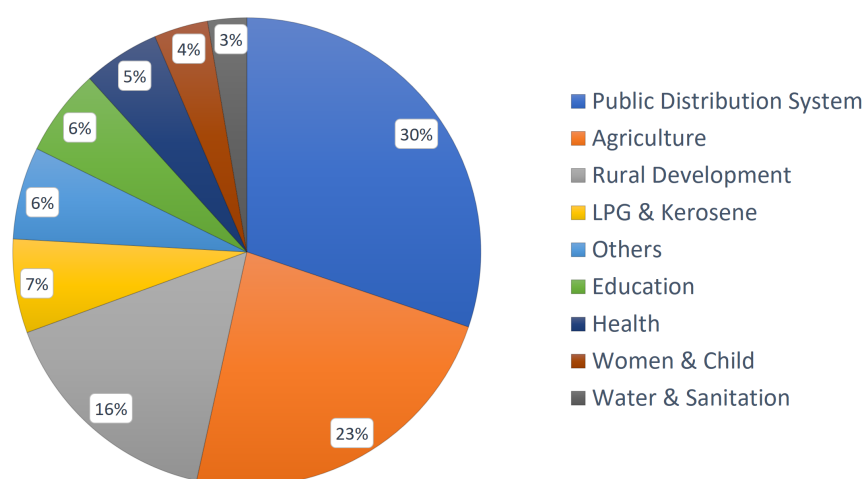
Note: Agriculture includes spending at Ministry of Agriculture and Ministry of Chemicals and Fertilizers (INR 103,911 crore); Public Distribution System refers to spending at Ministry of Consumer Affairs, Food and Public Distribution (INR 134,915 crore); Education refers to spending at Ministry of Human Resource Development (INR 26,853 crore); Rural Development refers to spending at Ministry of Rural Development (INR 71,316 crore); Health refers to spending at Ministry of Health and Family Welfare (INR 23,685 crore); LPG & Kerosene refers to spending at Ministry of Petroleum and Natural Gas (INR 28,947 crore); Women & Child refers to spending at Ministry of Women & Child Development which is predominantly on ICDS (INR 16,686 crore); Water & Sanitation refers to spending at Ministry of Drinking Water and Sanitation (INR 12,000 crore); Others refers to spending at: Ministry of AYUSH; Ministry of Finance, Dept. of Financial Services; Ministry of Power; Ministry of Labour; Ministry of Micro, Small and Medium Enterprises; Ministry of Minority Affairs; Ministry of New and Renewable Energy; Ministry of Skills; Ministry of Textiles; Ministry of Water Resources, River Development and Ganga Rejuvenation; Ministry of Social Justice & Empowerment; Ministry of Tribal Affairs (INR 28,517 crore). The total budgetary allocation for all welfare schemes is INR 446,830 crore (or approx 3 percent of GDP). All amounts are for 2016-17 (budgetary estimates).[4]

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[4]Special thanks to Vishnu Padmanabhan and Devesh Sharma for compiling and sharing data on welfare spending.

C.2   Supply chain management in PDS

Figure A2: Operations of PDS
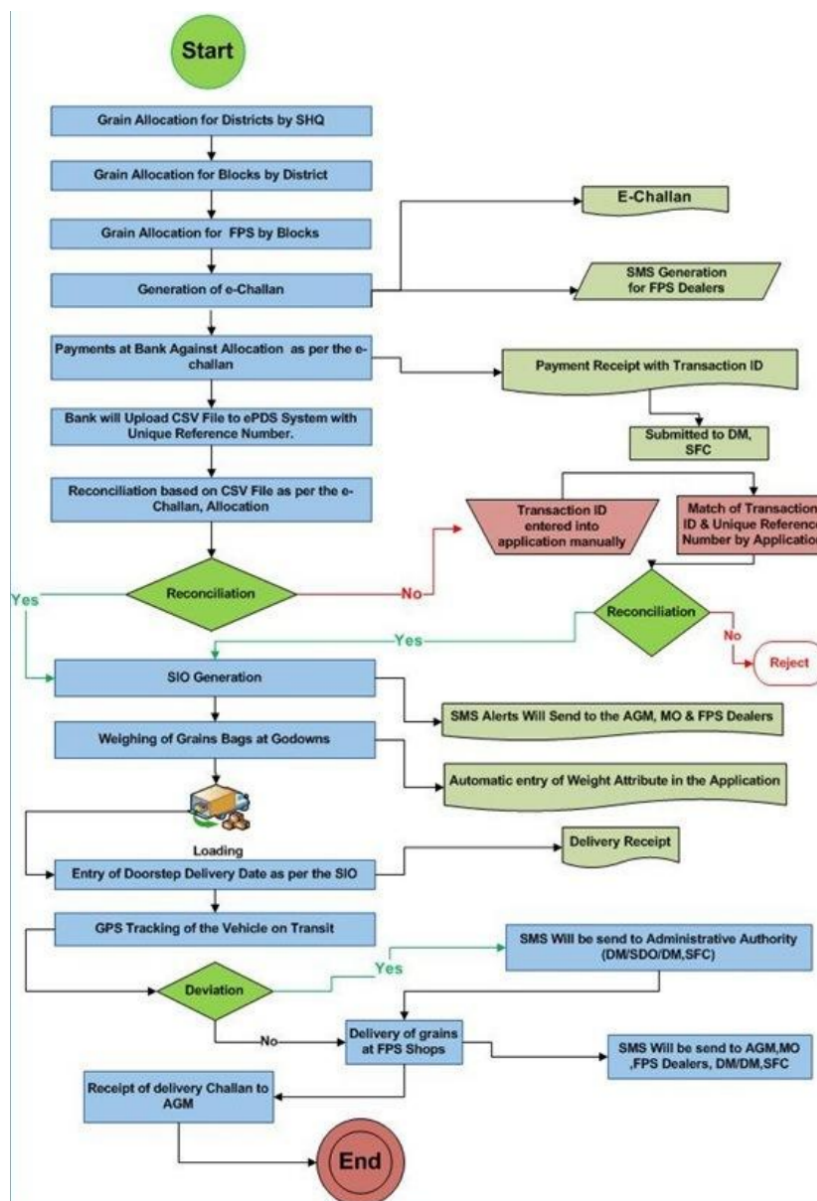
Note: This flowcharts illustrates the various steps involved in between allocation and dispatch of grains. Source: Operational, maintenance & customisation services to the Bihar State Food & Civil Supplies Corporation limited for the automation & monitoring of public distribution supply chain (e-PDS) project

Table A1: Coverage of sample in field experiment at sub-district level

	FPS in	FPS in study sample			Proportion of FPS
	sampled blocks	Control	Treatment	Total	in study sample
Gaya	314	21	22	43	14%
Munger	349	23	25	48	14%
Saharsa	301	18	17	35	12%
Sitamarhi	306	17	15	32	10%
Total	1,270	79	79	158	12%

Table A2: Intensity of treatment, at FPS level (calls sent as a proportion of all households in . . .)

District	...entire FPS	...sampled village
Gaya	26%	42%
Munger	22%	31%
Saharsa	17%	20%
Sitamarhi	18%	25%
Total	22%	31%