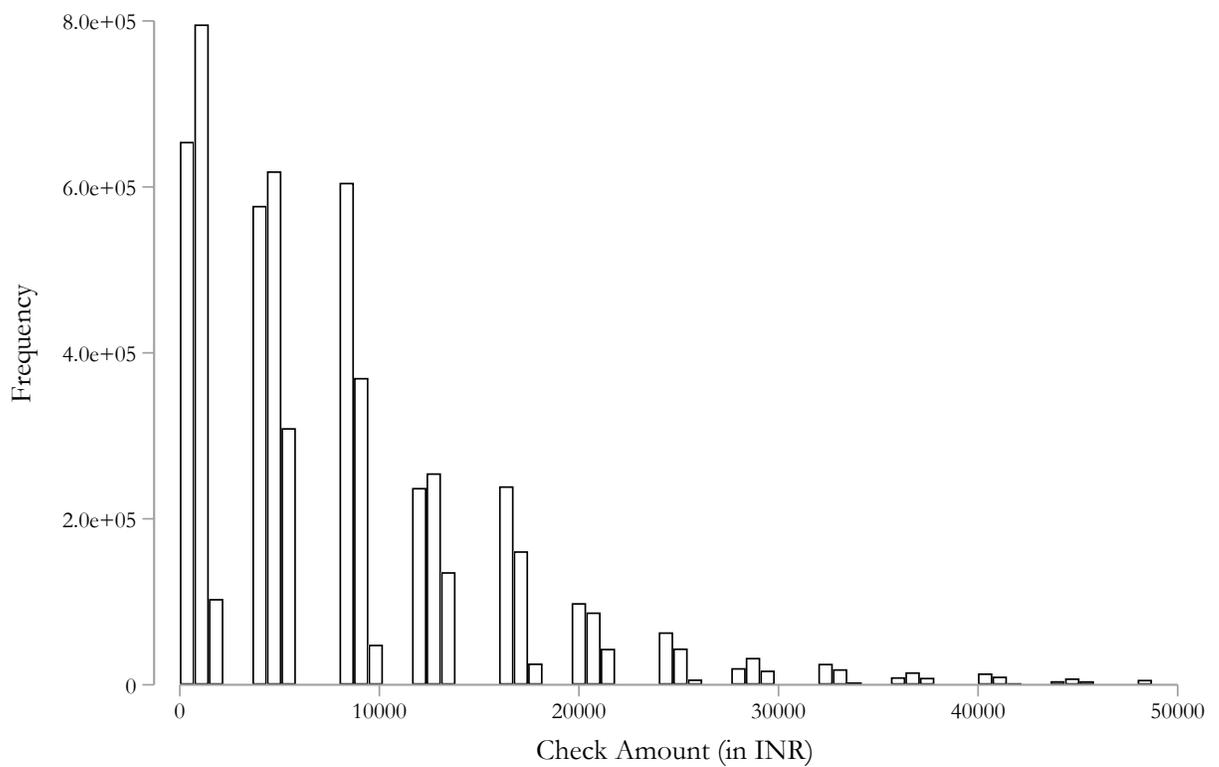# Online Appendix
Improving Last-Mile Service Delivery using Phone-Based Monitoring

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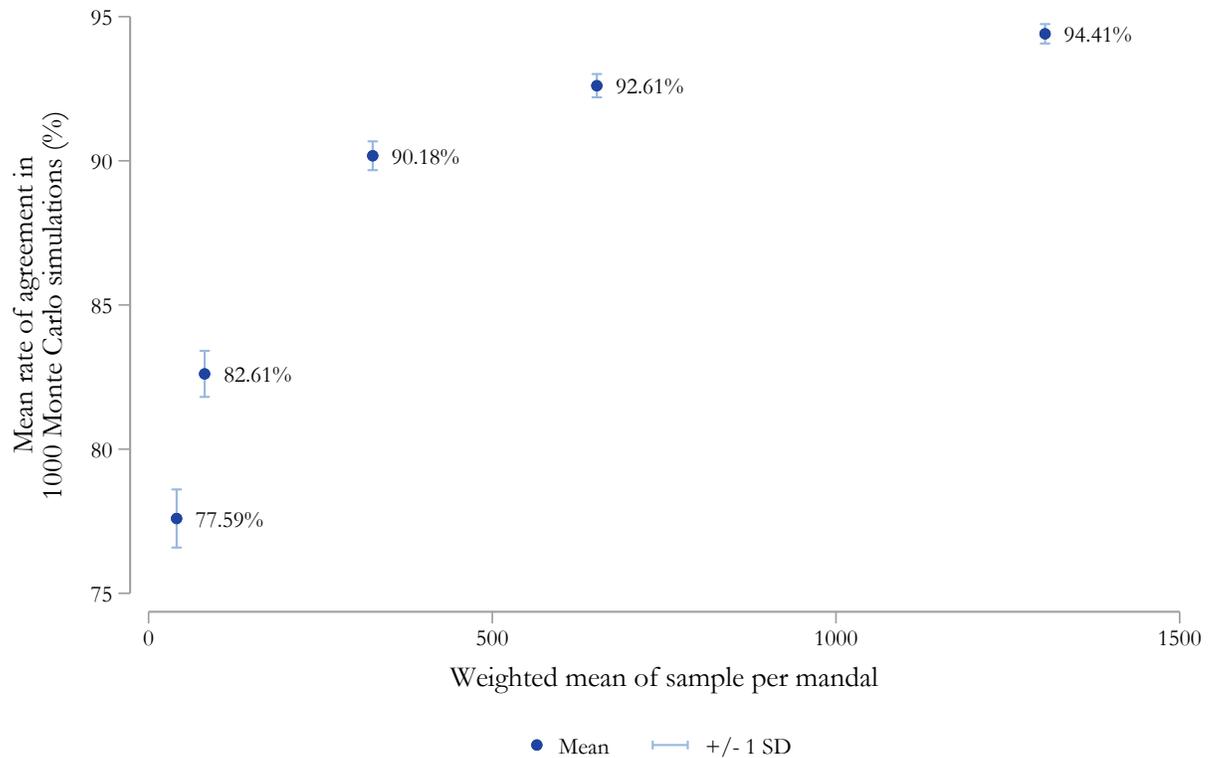Jeffrey Weaver

A   Appendix Tables and Figures

Figure A.1: Distribution of Check Amounts Under Rythu Bandhu

This graph shows the frequency of check amounts in our sample, excluding the top 1% of landowners, corresponding approximately to amounts greater than INR 50,000.

Figure A.2: Phone Call Sample Size and Agreement Rate

To produce the above graph, we ran 1000 Monte Carlo simulations in which we selected (with replacement) X farmers per mandal from the full sample of farmers, calculated the rate of check encashment in each mandal in the simulated sample using the bank database, and produced a ranking of MAOs in each district in the simulated sample. We then calculate how often the simulated sample and full administrative data rank the relative performance of a pair (m, m') of MAOs within a district the same way. For example, suppose the call center rates MAO A as 3rd and MAO B as 4th best. If the administrative data rates them as 2nd and 3rd best respectively, then since both sources ordered MAO A as performing better, we consider the sources to be in agreement. On the other hand, if the administrative data rated them as 3rd and 2nd best respectively, then we would not consider them to be in agreement: MAO A is ranked better than MAO B by the call center, but not by the administrative data. This graph shows the rate of agreement for each sample size, where as the sample size increases, the rate of agreement will naturally increase.

Table A.1: Effect of MAO Survey Among Control MAOs

	Ever encashed		Encashed on time		Days to encashment	
	(1)	(2)	(3)	(4)	(5)	(6)
Sampled for MAO survey	0.00876 (0.00767)		0.0112 (0.0107)		-0.0214 (0.438)	
Completed MAO survey		0.00219 (0.00839)		0.00127 (0.0124)		0.249 (0.534)
Observations	4348248	4348248	4348248	4348248	3575083	3575083

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Outcome in header. All specifications include district fixed effects since a fixed number of MAOs in each district were sampled for the survey. Standard errors in parentheses and clustered at the MAO level.

Table A.2: Impact on beneficiary experience

	(1) Received at Gram Sabha	(2) Asked to Pay Bribe	(3) Satisfied with Scheme
Treatment	0.00759* (0.00457)	0.00108 (0.00230)	0.00232 (0.00359)
Control Mean	0.94	0.02	0.93
Observations	19890	19830	22329

Outcomes in header. Estimates are weighted using (inverse) sampling probability, as pre-specified, based on the probability that an individual was sampled for an attempted call. All specifications include randomization strata fixed effects. Standard errors are clustered at the MAO level and in parentheses. The number of observations varies due to lower rates of response on some questions, which were asked later in the phone survey.

Table A.3: Direct Effect of Reports on Encashment (Hazard Model)

	Exponential Proportional Hazard		Stratified Cox	
	(1)	(2)	(3)	(4)
Treatment	0.074**	0.034**	0.044**	0.041**
	(0.030)	(0.017)	(0.021)	(0.020)
Treatment × Report		-0.045		-0.023
		(0.079)		(0.039)
Observations	5527320	5527320	4560929	4560929

Model specification in header. All specifications include fixed effects at the randomization strata fixed level. Standard errors are clustered at the MAO level and reported in parentheses.

Table A.4: Testing for spillovers

	(1) Ever distributed	(2) Ever encashed
Number of treatment mandals in revenue division	0.000679	0.00847
	(0.00473)	(0.00551)
Observations	399	399

As pre-specified, this table tests for the possibility that these results could be explained by supervisors of MAOs focusing more attention on treatment MAOs. Districts in Telangana are divided into "revenue divisions," which each contain several mandals. Although roughly the same fraction of mandals were treated in each district, we did not stratify the randomization at the revenue division level. As a result, there is random variation in the fraction of MAOs within each revenue division that are treated. If there were diversion of revenue division supervisor-level attention and attention matters for performance, we should expect worse performance among control MAOs with more treated MAOs in their revenue division, as these control MAOs would get less attention paid to them. This table does not find this to be the case. Outcome in header. All specifications include fixed effects for districts and number of mandals in the revenue division. Standard errors in parentheses and clustered at the revenue division level. 17 mandals could not be matched to revenue divisions, so were not included.

Table A.5: Effect of Being Randomly Selected for Calls

	(1) Ever encashed	(2) Encashed on time	(3) Days to encashment
Sampled for phone survey	-0.000059	-0.003	0.016
	(0.0014)	(0.002)	(0.083)
Observations	3500017	3500017	3134515

Outcome in header. Each specification contains mandal fixed effects, as this is the unit at which random sampling of farmers to be called by the call center was done. Standard errors are clustered at the farmer level. These observations only include farmers who had a listed phone number, and hence a non-zero chance of being sampled for the phone survey.

Table A.6: Main Outcomes, Excluding Those Randomly Selected for Calls

	(1) Ever encashed	(2) Encashed on time	(3) Days to encashment
Treatment	0.013**	0.023***	-0.770**
	(0.006)	(0.008)	(0.382)
Observations	5537302	5537302	4569539

Outcome in header. All specifications include fixed effects at the randomization strata fixed level. Standard errors are clustered at the MAO level and reported in parentheses. These observations do not include farmers who were randomly sampled to be called by the call center.

Table A.7: Comparing encashment outcomes in phone and administrative data

	(1)	(2)	(3)
	Actual agreement rate	Agreement rate from sampling variation	Residual disagreement rate
Pair-wise order of rankings	68.5%	77.6%	9.1%
Bottom 20% in PD found in bottom 20% of AD	43%	61.7%	18.7%
Bottom 20% in PD found in bottom 50% of AD	83%	92.7%	9.7%

AD (Administrative Data). PD (Phone Data). The actual rate of agreement between phone and administrative data is reported in (1). Next, a comparison is made between the entire population of administrative data and 1,000 random draws of farmers sampled from the administrative data, where each draw is the size of the phone call sample. The mean of these 1,000 agreement rates is reported in (2), showing the amount of disagreement that we would expect due simply to sampling variation in which farmers were selected for the phone call sample. The residual disagreement rate after accounting for (2) is reported in (3).

Table A.8: Comparing encashment outcomes in phone and administrative data

	(1) Phone Data	(2) Admin Data
Treatment	0.00219	0.0131
	(0.00982)	(0.0111)
Observations	22005	22005
Control mean	0.75	0.73
Chi-squared test p-value (vs. (1))		0.46

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Reports Sent to District and Mandal Agricultural Officers

II.A Report to Mandal Agricultural Officers - Example

Report on Rythu Bandhu Scheme in (Mandal name)[46]

Dear (MAO Name),

As you were informed at the beginning of May, the Department of Agriculture carried out a pilot program in your mandal during the Rythu Bandhu Scheme. For this program, a call center called farmers from all of the villages in your mandal and collected information about their experience with the Rythu Bandhu scheme. The below table gives the results of this survey.

The first row gives the percentage of farmers who received their cheques in your mandal, as well as in the whole district and the state. The second row is the percent of farmers who received their cheques before May 20th. The third row is the percent of farmers who reported being satisfied or very satisfied. The fourth row is the percent who have successfully encashed their cheques, if they got them. The fifth row is the percent of farmers who reported having a payment demanded for receiving their cheques.

This report will also be shared with district and state level agricultural officials.

We hope that the availability of this data on program performance is helpful to you. If you have any questions about this report, you can call (Name of member of field team) (Mobile number), an outside consultant who is working with Government of Telangana to implement the pilot.

(Name of bureaucrat)
Commissioner of Agriculture

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[46]The report was sent out in the working language of the state (Telugu). This is the original pre-translation version of the report.

Category	In Mandal	District Average	State Average	Overall Rating
Farmers Received Cheque	90.5%	82.2%	83.3%	Excellent
Cheque Received Before May 20	43.9%	38.9%	45.1%	Fair
Satisfied Farmers	91.5%	93.4%	92.2%	Excellent
Successfully Encashed Cheque	81.1%	76.8%	75.4%	Excellent
Money Requested for Cheque	3.7%	2.0%	1.5%	Fair

GUIDE:

Farmers Received Cheque:
0-75% (Poor), 75%-80% (Fair), 80-85% (Good), 85-100% (Excellent)

Cheque Received Before May 20:
0-40% (Poor), 40%-50% (Fair), 50-60% (Good), 60-100% (Excellent)

Satisfied Farmers:
0-80% (Poor), 80%-85% (Fair), 85-90% (Good), 90-100% (Excellent)

Successfully Encashed Cheque:
0-55% (Poor), 55%-60% (Fair), 60-75% (Good), 75-100% (Excellent)

Money Requested for Cheque:
>4% (Poor), 2%-4% (Fair), 1-2% (Good), 0-1% (Excellent)

Village	Cheque Received (%)	Cheque Encashed (%)
(VILLAGE 1)	84.1%	75.8%
(VILLAGE 2)	88.0%	48.6%
(VILLAGE 3)	88.4%	74.7%
(VILLAGE 4)	89.6%	79.6%
(VILLAGE 5)	90.4%	77.1%
(VILLAGE 6)	91.3%	77.9%
(VILLAGE 7)	91.6%	84.1%
(VILLAGE 8)	91.7%	80.4%
(VILLAGE 9)	91.9%	78.5%
(VILLAGE 10)	92.6%	80.4%
(VILLAGE 11)	93.4%	82.6%
(VILLAGE 12)	94.0%	85.4%
(VILLAGE 13)	94.3%	80.3%
(VILLAGE 14)	95.3%	82.3%
(VILLAGE 15)	96.1%	81.4%
(VILLAGE 16)	96.7%	82.6%
(VILLAGE 17)	96.7%	79.1%
(VILLAGE 18)	97.0%	76.6%
(VILLAGE 19)	97.1%	83.1%
(VILLAGE 20)	97.9%	74.5%

II.B   Report to District Agricultural Officers - Example

Report on Rythu Bandhu Scheme in (District name)[47]

Mandal	MAO Name	Farmers Received Cheque	Cheque Received Before May 20	Satisfied Farmers	Successfully Encashed Cheque	Money Requested for Cheque
(Mandal 1)	(MAO 1)	79.3% Fair	38.0% Poor	91.3% Excellent	65.2% Good	1.1% Good
(Mandal 2)	(MAO 2)	78.7% Fair	36.0% Poor	88.0% Good	73.3% Good	2.7% Fair
(Mandal 3)	(MAO 3)	80.5% Good	43.9% Fair	91.5% Excellent	78.1% Excellent	3.7% Fair

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[47]The report was sent out in the working language of the state (Telugu). This is the original pre-translation version of the report.

C Discussion of disbursement and encashment data

The Agriculture Department at the Government of Telangana (GoTS) wanted to collect administrative data on the progress of the Rythu Bandhu program using two independent databases. The first database was maintained by MAOs. MAOs were given tablets on which they were supposed to input which checks had been distributed on a given date. The second database was maintained by banks, and tracked whether each check was encashed and the date of encashment. The bank database was updated in real-time as checks were cleared.

Clearly, the reliability of these systems may differ: the MAO-based system depends on clerical and administrative processes, while the bank-based system is linked with existing payment systems and largely mechanized. Banks were required to maintain updated data to ensure they received payments from the government, while we observed that the MAO-based system was updated in a more haphazard and inconsistent manner. We did not know this during the study design phase, but after observing the distribution process, we came to suspect that the MAO-based data on distribution of checks may not be as reliable as bank-based systems on encashment.

We conducted a number of checks and found that the suspected unreliability of MAO-based distribution indicators was borne out in the data itself, such as in the following instances:

- We received the up-to-date MAO and bank-based databases at three points in time: once in July, once in August, and once in September 2018. When we compare the September data to the previous two rounds, we see that for 1% of the observations, disbursement status was revised from "distributed" to "not distributed". This indicates an error was caught in these cases, but is worrisome since there may be other errors that were missed. The bank-based data had no such revisions.

- The September round of data lists dates of distribution for 700K checks that are also recorded as never having been distributed.

- From our conversations with GoTS, there was a misunderstanding on the part of MAOs regarding the date of distribution indicator. A significant number of MAOs updated the "date of distribution" field with the date on which they uploaded their data, which may be weeks after the actual date of distribution. This is obvious in the data, where many MAOs are recorded as distributing an impossibly large number of checks on a given day, with no checks delivered on other working days. Based on this, we do not believe the date of distribution field to be a usable indicator for speed of distribution.

- There are substantial revisions in the indicator for date of distribution in the MAO-based database. Between the three rounds of data, there are differences in dates of distribution in 1-5% of the observations.

Overall, there are significant reasons to distrust the MAO-based data on check distribution, including that MAOs might have tried to overstate their performance by recording that they distributed more checks than they actually did. The bank-based data on check encashment, on the other hand, do not have these concerns and closely match data from the phone surveys. We report results below in tables A.9 and A.10 based on the MAO database since we committed to this in the pre-analysis plan, but believe the outcomes to be noisily measured in that dataset as compared to the check encashment data.

Table A.9: Effect on check distribution outcomes (MAO reports)

	Distributed before June 8th		Ever distributed		
	(1)	(2)	(3)	(4)	(5)
	Treatment	Control mean	Treatment	Control mean	Obs.
Overall	0.00924 (0.00653)	0.81	0.00793* (0.00468)	0.87	5,645,937
Land quartiles					
Quartile 1	0.0177* (0.00984)	0.67	0.0165* (0.00878)	0.74	1,449,482
Quartile 2	0.00955 (0.00634)	0.83	0.00910** (0.00417)	0.89	1,460,294
Quartile 3	0.00742 (0.00568)	0.87	0.00654** (0.00319)	0.92	1,443,788
Quartile 4	0.00546 (0.00569)	0.87	0.00371 (0.00334)	0.93	1,443,836
Test of H_o: $\beta_{Q1} = \beta_{Q2} = \beta_{Q3} = \beta_{Q4}$	*0.43 (0.73)*		*1.18 (0.32)*		
Phone coverage					
No listed phone	0.00814 (0.0114)	0.69	0.00673 (0.0104)	0.76	2,254,142
Listed phone	0.00544 (0.00536)	0.89	0.00498* (0.00269)	0.94	3,543,258
Test of H_o: $\beta_{No-Phone} = \beta_{Phone}$	*0.10 (0.75)*		*0.08 (0.78)*		

All specifications include fixed effects at the randomization strata fixed level. Standard errors are clustered at the MAO level and reported in parentheses. The bottom row of each panel reports the F-statistic and p-value from a test of the null that coefficients are statistically similar across categories.

Table A.10: Effect on time to distribution (MAO reports)

	Days till distributed		
	(1) Treatment	(2) Control mean	(3) Observations
Overall	-0.125 (0.310)	11.70	4,930,113
Land quartiles			
Quartile 1	-0.220 (0.386)	13.55	1,082,824
Quartile 2	-0.0543 (0.312)	11.53	1,302,380
Quartile 3	-0.104 (0.299)	18.71	1,334,261
Quartile 4	-0.232 (0.297)	11.23	1,343,004
Test of H_o : $\beta_{Q1} = \beta_{Q2} = \beta_{Q3} = \beta_{Q4}$		*0.61 (0.61)*	
Phone coverage			
No listed phone	-0.128 (0.403)	13.85	1,729,723
Listed phone	-0.0826 (0.286)	10.57	3,332,746
Test of H_o : $\beta_{No-Phone} = \beta_{Phone}$		*0.05 (0.83)*	

All specifications include fixed effects at the randomization strata fixed level. Standard errors are clustered at the MAO level and reported in parentheses. The bottom row of each panel reports the F-statistic and p-value from a test of the null that coefficients are statistically similar across categories.