



Project from Start to Finish

Building State Capacity: Biometric Smartcards in India

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Overview of Key Steps in Conducting a Field Experiment

- 1 Define the research question(s)! Why does it matter? What are the likely mechanisms of impact?
- 2 Identify the evaluation methodology. Internal & external validity. Is an experiment the best way to answer the question of interest?
- 3 Making it happen: Identify sites, implementation partners and structure, permissions, funding, key personnel
- 4 Fine tune the details: pilot and refine measurement instruments, power and sample size calculations, get feedback on design
- 5 Conduct baseline (is this always necessary)? Do randomization, implement treatments, monitor process and outcomes
- 6 Data cleaning & management, analysis, writing papers/reports, presenting for feedback, refine, peer-review, disseminate

Motivation

- The G2P (Government to Person) payment space is worth > \$100 Billion/year
- Large amounts of leakage in these transfers
 - 85% in Ugandan schools
 - ~30-70% in NREGS in India
 - [Rajiv Gandhi quote: only 15p of every Rupee reaches poor]
- Significant inconvenience for beneficiaries in collecting benefits/payments under various public programs
- Cost of both factors increases in a context of expanding welfare states in several developing countries

EBT + Biometrics: a solution?

- Secure payments infrastructure = electronic transfers + biometric authentication = investment in “state capacity” to deliver public welfare and anti-poverty programs
- ID programs in > 80 countries
 - e.g. UID/Aadhaar in India
- Aadhaar-enabled EBT will be “game changer” for governance (former FM Chidambaram)
 - Reduce “ghosts”, leakage



Yet...

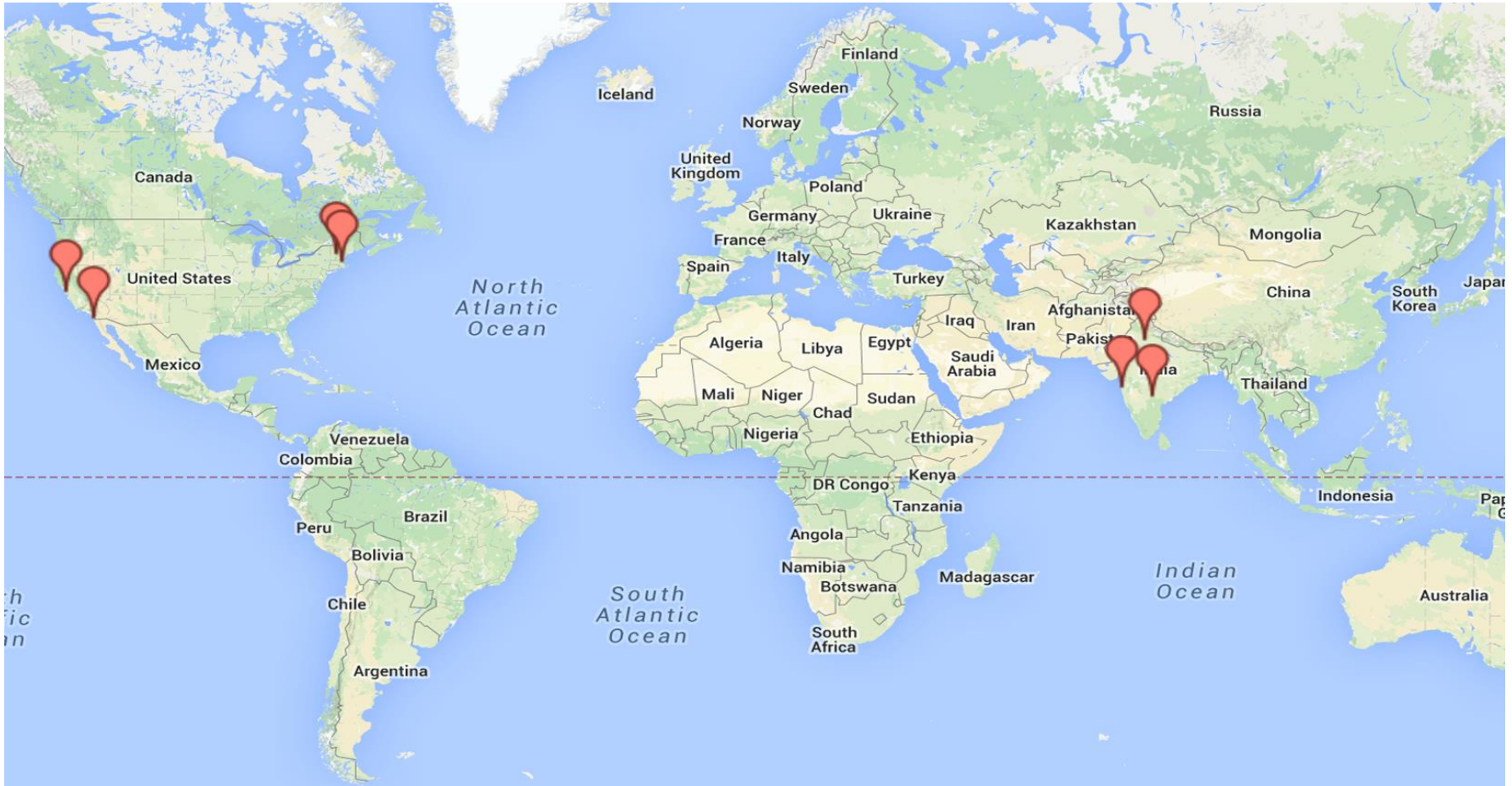
- A number of reasons to doubt the hype
 1. Implementation and logistical challenges at scale; getting everything right difficult
 2. Subversion by vested interests whose rents are threatened
 3. Negative effects on access through dampened incentives for officials
 4. Exclusion errors if legitimate beneficiaries denied payments, leaving poorest worse off
 5. Cost-effectiveness unclear, based on untested assumptions
- Little to no credible evidence on effectiveness

The AP Smartcards Project

- We worked with Govt of Andhra Pradesh to randomize rollout of biometrically authenticated EBTs (“Smartcards”) in 8 districts, 157 subdistricts
 - Smartcards were linked to bank accounts, and integrated with workfare (NREGS) and pension (SSP) schemes
- Evaluation “as is”, at-scale
 - *NOT* small pilot run by high-functioning NGO



Many partners



JPAL Global, JPAL-SA, UIDAI, AP Government, Omidyar Network, IPA, US Universities

Research questions

1. Do Smartcards improve the payment process?
2. Do Smartcards reduce leakage?
3. Does beneficiary access suffer?
4. Are the poorest worse off?
5. What are the channels of impact?
6. Is the intervention cost-effective?
7. [Are markets/ other outcomes affected?]

Agenda

I. Context and intervention

II. Research design

- Randomization
- Implementation

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- Program performance
- Heterogeneity and mechanisms
- Cost-effectiveness

IV. Discussion



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National Rural Employment Guarantee Scheme (NREGS)

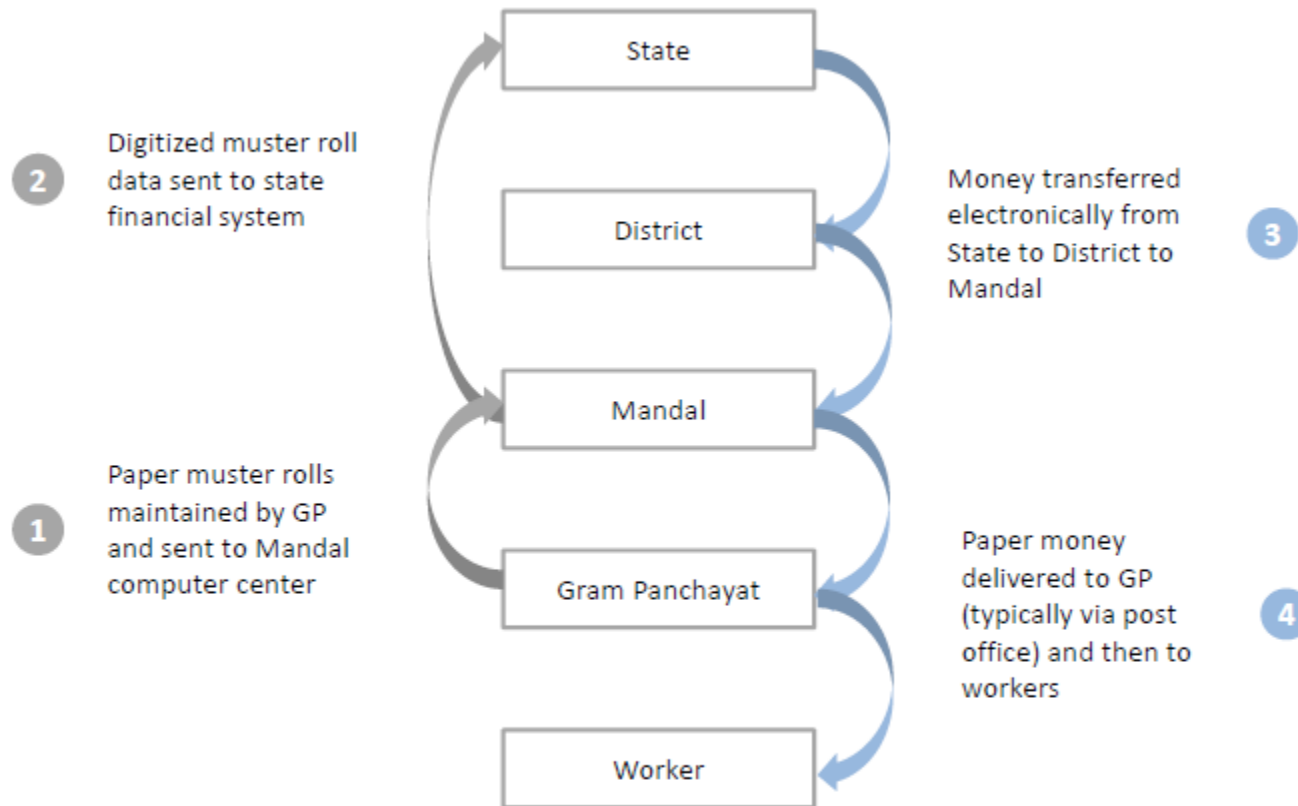
- Flagship social protection program (~ 0.5 % of GDP; covers 11% of world population; AP budget \$800M)
- No eligibility restrictions: sign up for a free jobcard and be willing to work
- Paid by amount of work done at minimum wages
- Payments often late, time-consuming to collect
- High estimated leakage rates
 - Over-reporting: worker owed Rs 100, official tells government she is owed Rs 150 and keeps Rs 50 for himself
 - Under-payment: worker owed Rs 100, official gives her Rs 90 and keeps Rs 10 for himself
 - Ghosts, quasi-ghosts: extreme forms of over-reporting with positive official claims, but zero work or payments (workers may or may not exist)



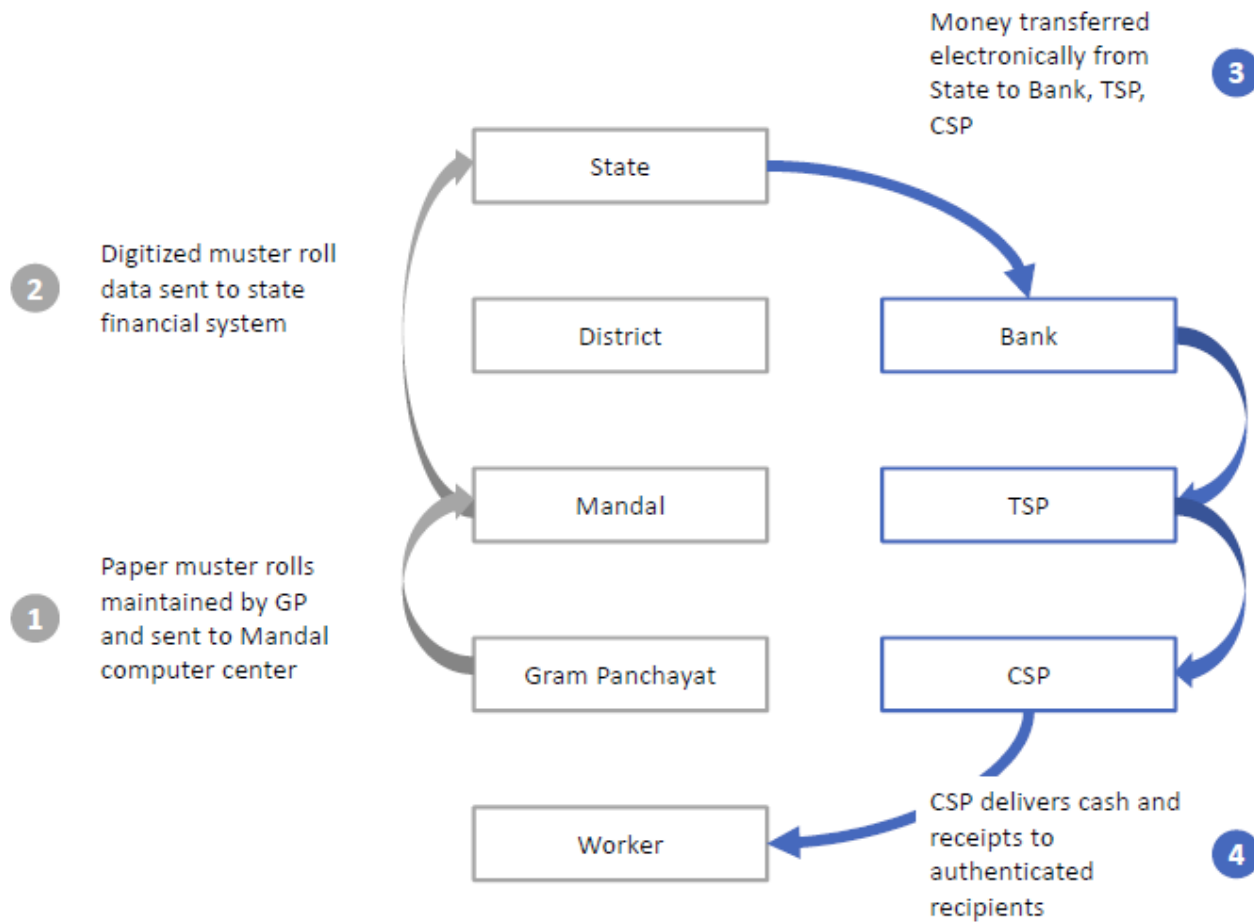
Social Security Pensions (SSP)

- Large state welfare program (AP budget \$360M)
- Eligibility: must be poor AND either widowed, disabled, elderly, or had (selected) displaced occupation
- Rs. 200 per month (Rs. 500 for select categories)
- Some evidence of ghosts, but lower initial leakage than NREGS
 - Over-reporting through miscategorization: beneficiary believes benefit is Rs 200, official claims Rs 500
 - Ghosts: non-existent or dead beneficiaries
 - Under-payment: beneficiary owed Rs 100, official gives her Rs 90 and keeps Rs 10 for himself

Status-quo: unauthenticated payments delivered by local officials



Smartcard-enabled: authenticated payments delivered by CSP





Issued on:
01/11/2008
Date of Birth:
[REDACTED] 1938



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001 [REDACTED] 315 - ZSN



Medak AP-502278



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Photo by Sandip Sukhtankar, July 2011

Smartcard intervention structure

- **Vendors:** Competitive procurement
 - Bank/Technology Service Provider (TSP) pairings
 - “One-district-one-bank” model
 - Banks receive 2% commissions after going live
- **Enrollment:** “Campaign” model with enrollment camps until reaching 40% threshold at the panchayat level, but no process for ongoing enrollment
- **Staffing:** Customer service provider (CSP) appointed by bank/TSP
 - Resident of village
 - Not related to local officials
 - 10th grade education
 - Member of self-help group
 - Preferably from lower caste
- **Technology:** Physical PoS devices using offline authentication but with GSM connectivity for data sync

Smartcards could impact program performance positively or negatively

Issue under status-quo	EBTs thru CSPs	Biometric authentication
Time to collect	Could help, CSPs should be closer to home	Could help (faster lookup) or hurt (slow authentication)
Payment delays	Could help (automated process) or hurt (TSP mishandles last-mile cash management)	Could hurt (non-working devices, data syncing problems)
Overreporting	Need to collude w/ CSP	Need to collude w/ workers
Ghosts	Need to collude w/ CSP	Harder to create without live fingerprints
Underpayment	Could help, lower social distance of CSP	Shifts bargaining power to beneficiaries
Program access	Could suffer if rents are reduced	

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Opportunity to evaluate mature payment system at scale

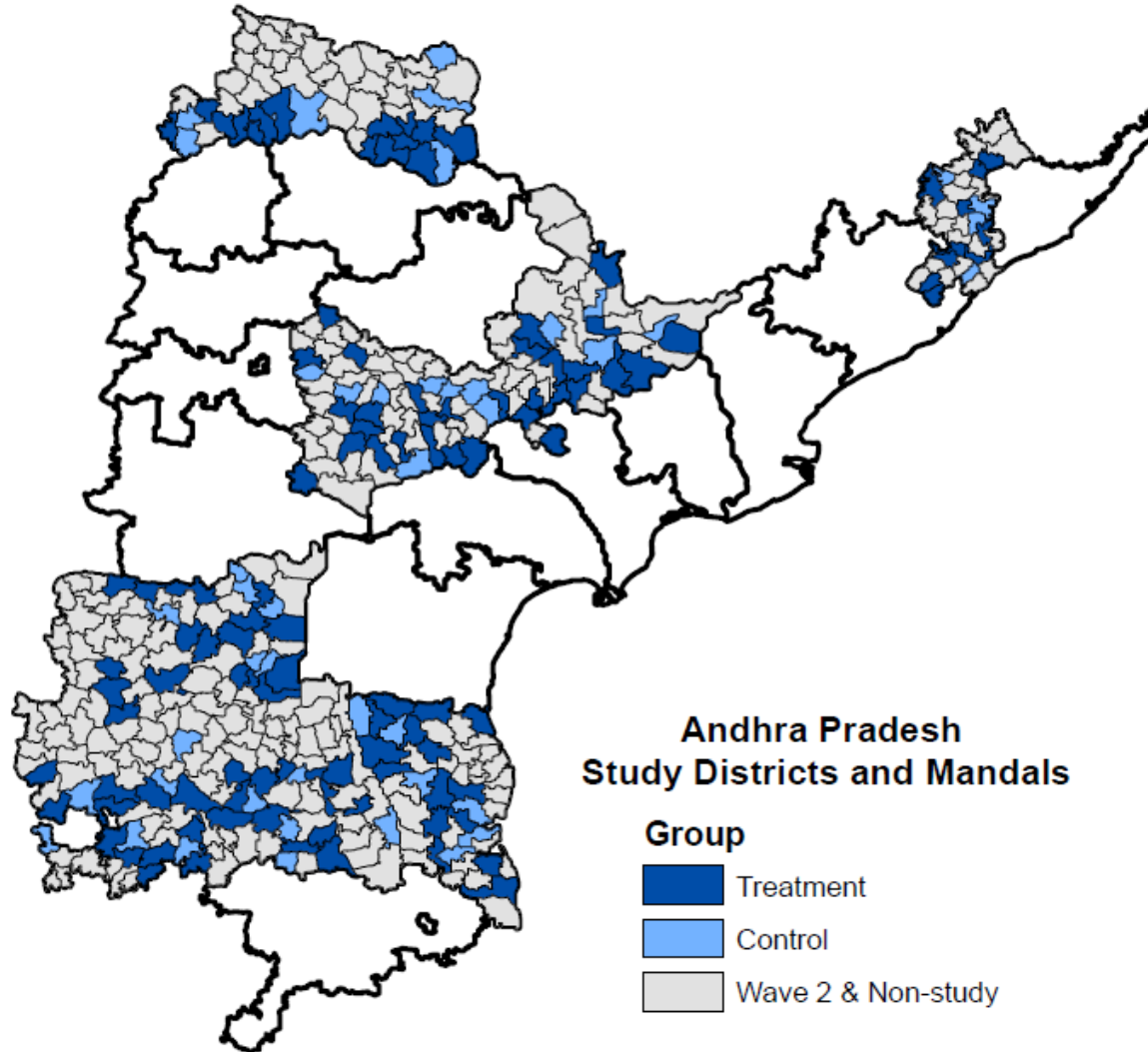
- MoU with Govt of Andhra Pradesh to randomize rollout at mandal (sub-district) level in 8 districts (2010-2012)
 - These districts had made no headway under initial vendors (2006), and were re-assigned to better-performing banks on a one-district-one-bank basis
 - Good time for evaluation since most major implementation issues resolved in other districts
 - Study districts very similar to remaining (non-urban) districts in AP
- Mandals randomized into three waves: treatment, non-study, and control
 - 45 control & 112 treatment mandals
 - 24 month lag between roll out in control and treatment mandals
 - Evaluation team worked with GoAP to ensure no contamination in control areas

Level of randomization

Randomization was at the mandal (sub-district, = block in other states) level, which is ideal on various counts

- Why not at the individual level?
- Why not at the village level?
- Why not at the district level

Study spread across AP



Andhra Pradesh = Germany (pop, size); ~19 million rural HH in study districts

= all-India averages on human development measures

= now 2 states!

Sampling & data collection

- All official records (beneficiary lists, benefits paid, days worked)
- Samples representative (after re-weighting) of the following frames
 - NREGS: All jobcard holders, over-weighting recent workers
 - SSP: All beneficiaries
- Village-level panel: baseline (Aug-Sep 2010) and endline (Aug-Sep 2012) surveys of ~ 8800 households
 - 880 villages (6/mandal in 6 districts, 4/mandal in 2)
 - 10 HH per village
- Survey collected data on program participation, performance, benefits; income, employment, consumption, loans, and assets; village-level economic, political, and social data
- [+ data from SECC, livestock census, district handbooks, etc]

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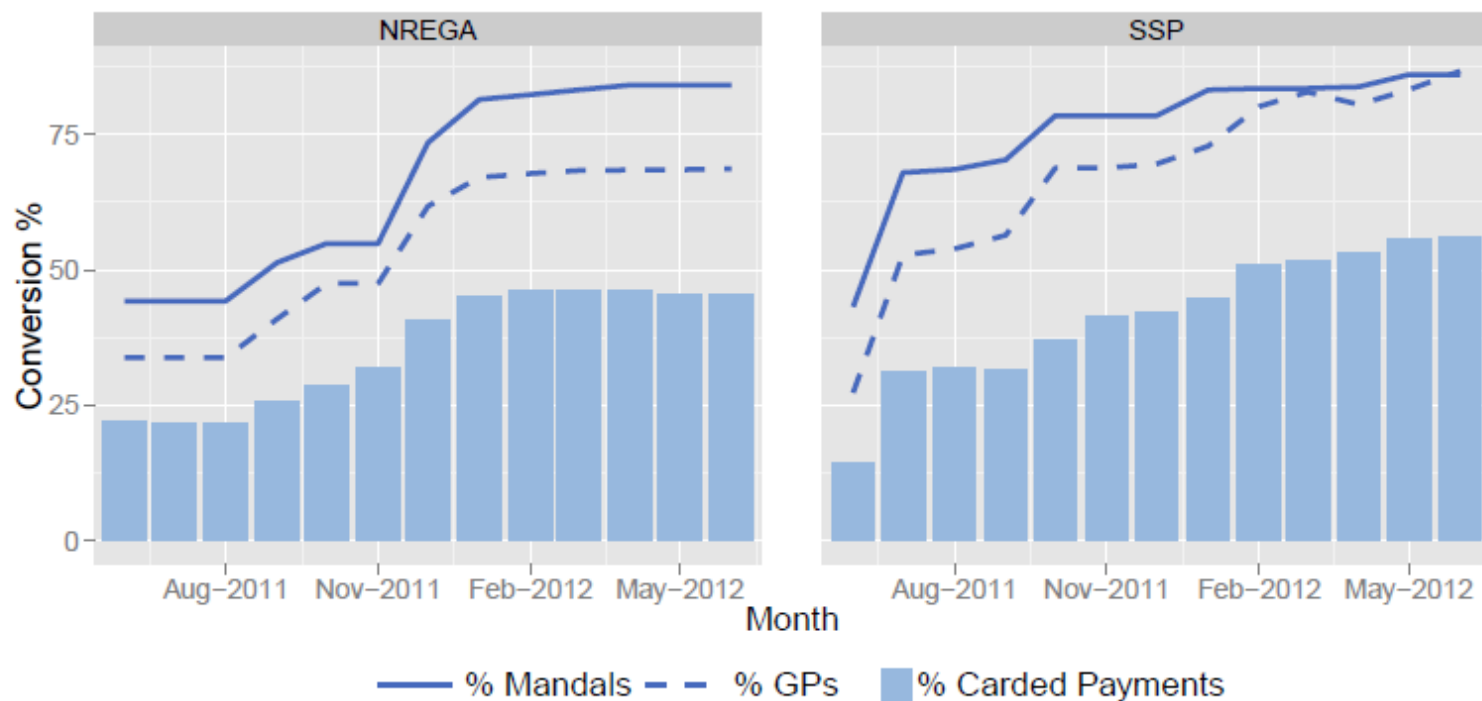


Implementation faced hurdles

- Various challenges
 - Logistics and enrollment; incentives in bank contracts; pushback from vested interests; politics costs
- GoAP achieved 50% coverage in rolling out carded payments over 2 years
- Some relevant comparisons
 - Replacing checks with EBT in Social Security took 15 years
 - 4Ps in Philippines took 5 years for 40% coverage
- We present ITT estimates = policy parameter of interest, net of all implementation challenges

NGREGA/SSP roll-out progress since June 2011

Wave I (Treatment) mandals



Estimation

- $Y_{ipmd} = \alpha + \beta Treated_{md} + \gamma Y^0_{pmd} + \delta District_d + \rho PC_{md} + \epsilon_{ipmd} \quad (1)$
- Observations indexed by individual l , panchayat p , mandal m , district d
- Treatment probabilities were constant within districts
- Given village-level panel, we include lagged village-level mean of depend variable Y^0_{pmd} (when available); also include principal component of vector of mandal-level characteristics on which we stratified
- Standard errors clustered at mandal level
- Weighted to obtain average partial effects for population of NREGS jobcard holders / SSP beneficiaries

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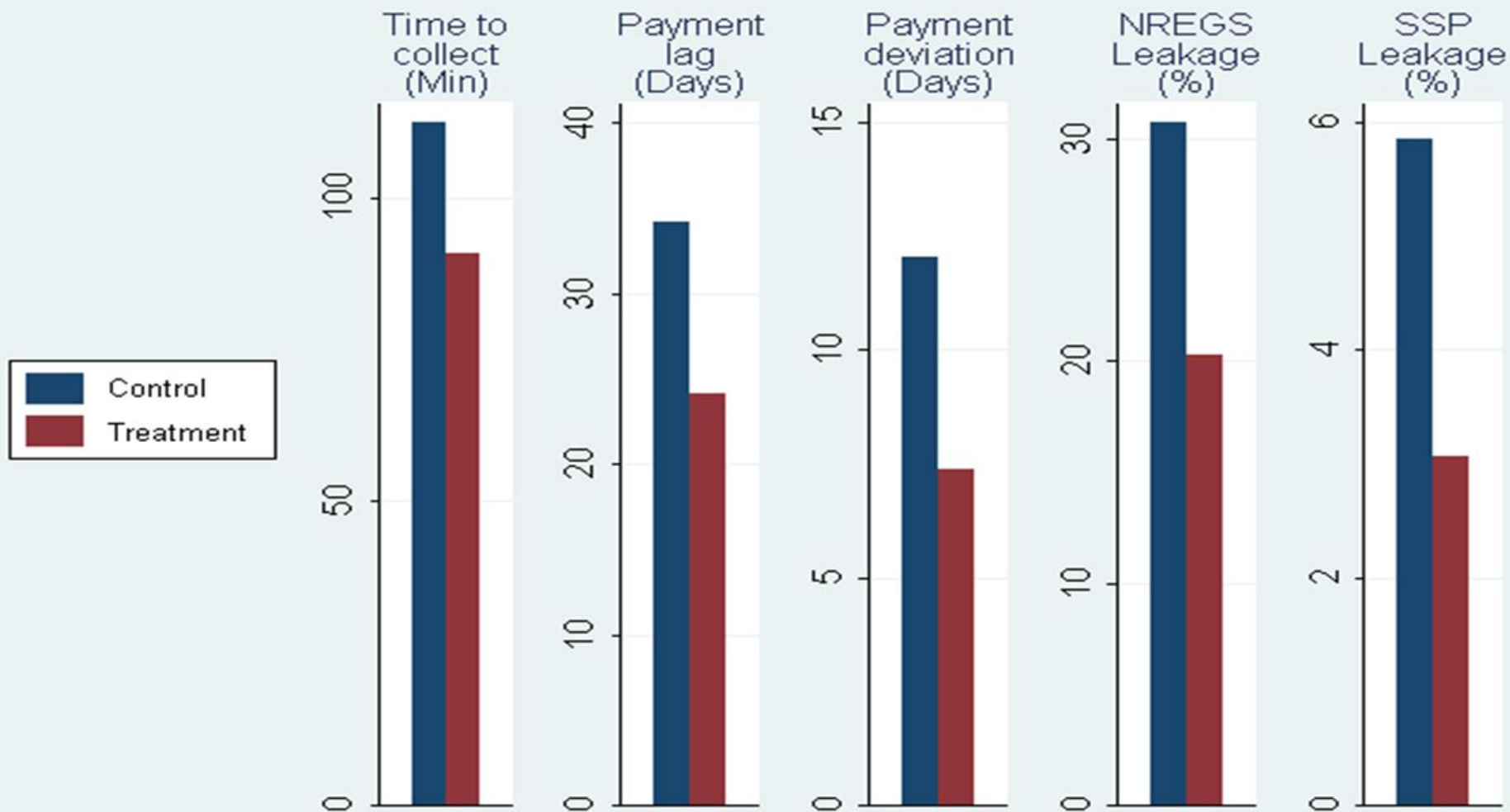
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Program performance improved on all dimensions



Despite reduced corruption, access improved

	Proportion of Hhds doing NREGS work		Was any Hhd member unable to get NREGS work in...		Is NREGS work available when anyone wants it		Did you have to pay anything to get this NREGS work?	
	(1) Study Period	(2) Study Period	(3) May	(4) January	(5) All Months	(6) All Months	(7) NREGS	(8) NREGS
Treatment	.072** (.033)	.071** (.033)	-.023 (.027)	-.027 (.033)	.027* (.015)	.024 (.015)	-.0003 (.0015)	-.00054 (.0015)
BL GP Mean		.14*** (.038)				-.023 (.027)		-.0064** (.0031)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	.05	.06	.10	.11	.02	.02	.00	.00
Control Mean	.42	.42	.2	.42	.035	.035	.0022	.0022
N. of cases	4943	4909	4748	4496	4755	4715	7185	6861

- Why did access not deteriorate (and in fact improve)?
 - Insufficient time for officials to react? But, see above.
 - Few substitutable activities? Note dedicated Field Assistant role (and leakage was still positive albeit lower)

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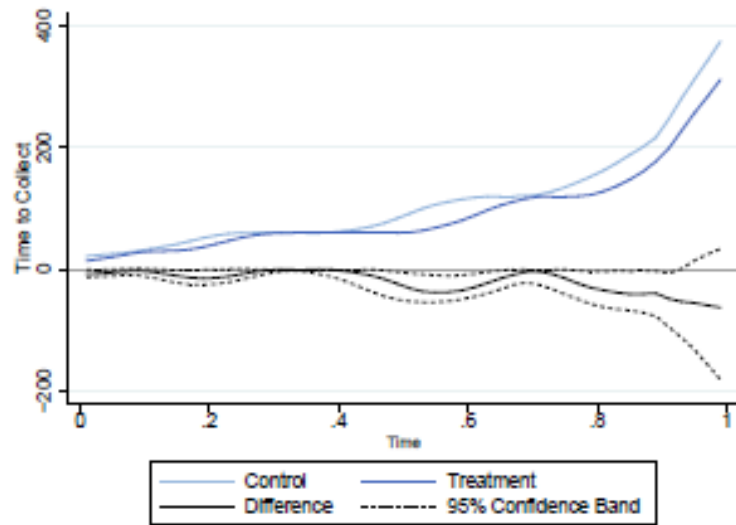
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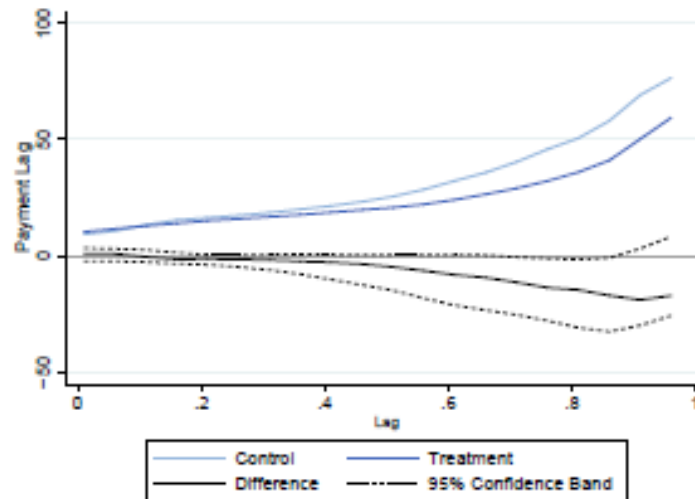
Was anyone made worse off?

- We test along three dimensions
 1. Distributional impacts on main outcomes (quantile TE)
 2. Heterogeneous treatment effects across baseline distributions of main outcomes
 3. Non-experimental decompositions along carded/non-carded GPs/households
 - In particular, are uncarded beneficiaries in carded GPs worse off
 - Also relevant for understanding mechanism of impact
- We also examine beneficiary perceptions of the intervention

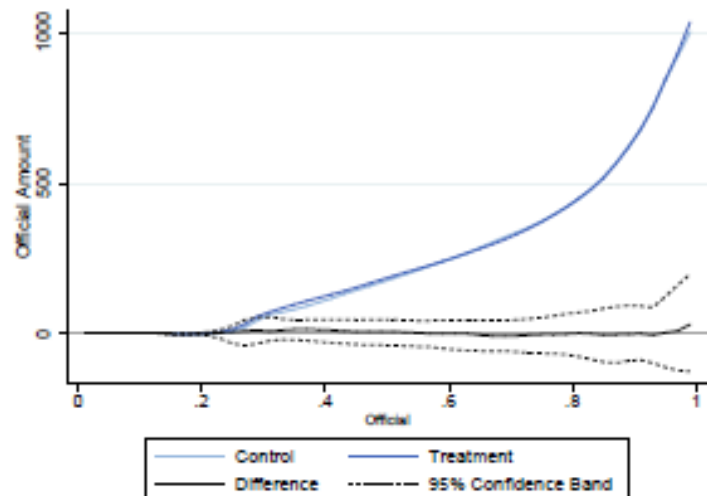
Treated distributions stochastically dominate control - NREGS



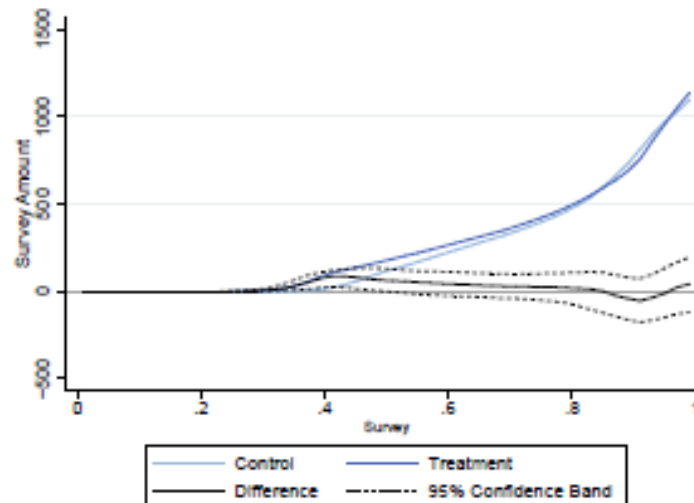
(a) Time to collect: NREGS



(b) Payment Lag: NREGS



(c) Official: NREGS



(d) Survey: NREGS

No significant heterogeneity by baseline characteristics

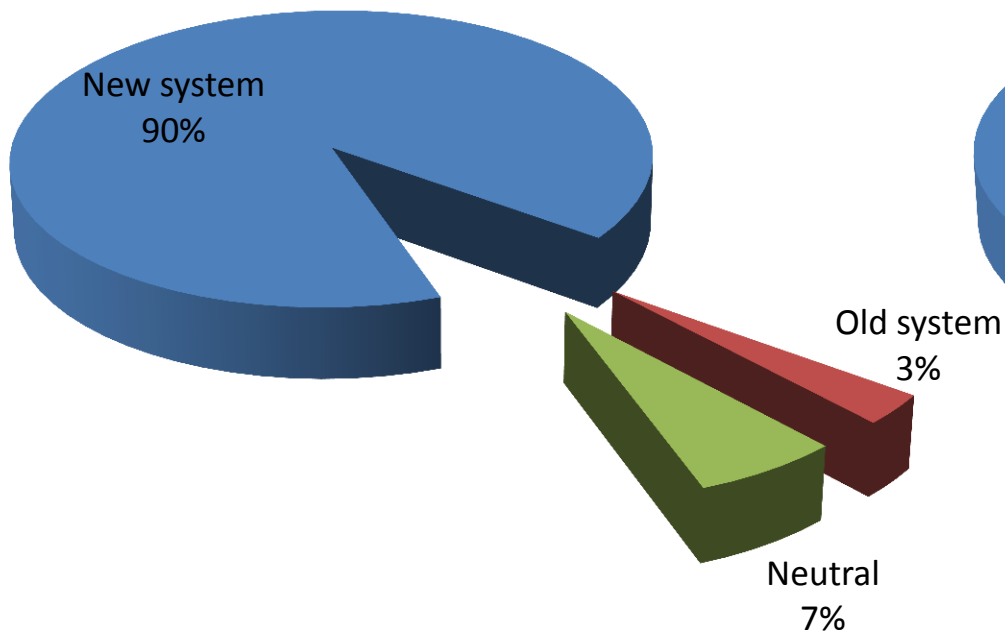
	<u>Time to Collect</u>	<u>Payment Lag</u>	<u>Official Payments</u>	<u>Survey Payments</u>
	(1)	(2)	(3)	(4)
BL GP Mean	.024 (.08)	.19 (.25)	.012 (.042)	.048 (.074)
Consumption (Rs. 1,000)	-.085 (.16)	-.0045 (.025)	-.0024 (.2)	-.044 (.26)
GP Disbursement, NREGS (Rs. 1,000)	.015* (.0078)	.00014 (.0013)	.014 (.01)	.0044 (.016)
SC Proportion	.31 (48)	25* (13)	3.6 (49)	13 (51)
BPL Proportion	-.61 (127)	-.24 (22)	-.64 (111)	-.171 (114)
District FE	Yes	Yes	Yes	Yes
Week FE	No	Yes	No	No
Control Mean	112	34	127	146
Level	Indiv.	Indiv-Week	Hhd	Hhd
N. of cases	10143	12334	4999	4999

Organizational and technological mechanisms of impact

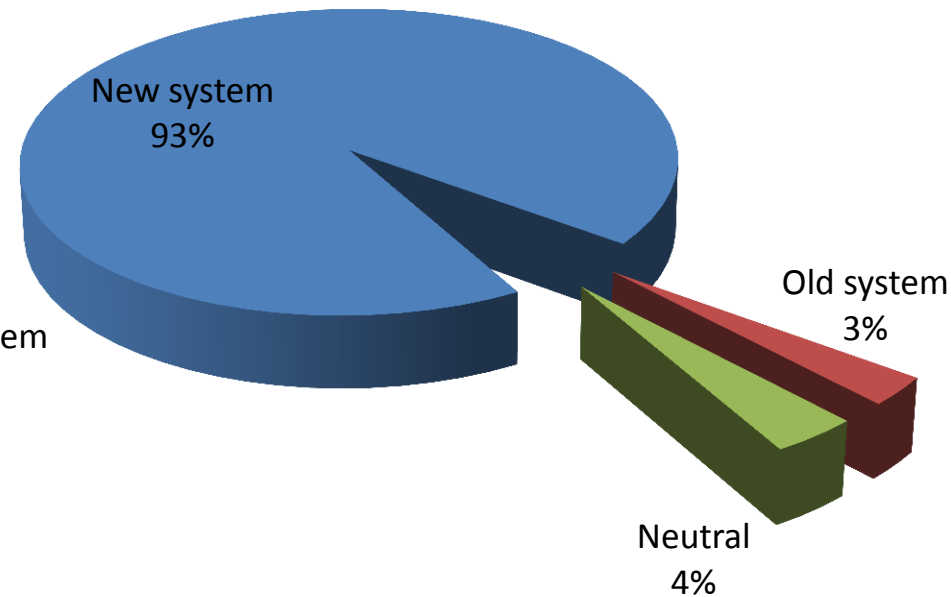
	Time to collect		Payment lag		Official		Survey		Leakage	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Carded GP	-33*** (8.1)		-4.9* (2.8)		10 (13)		40** (15)		-29** (13)	
Have SCard, Carded GP		-33*** (8.4)		-4.7 (2.9)		93*** (17)		169*** (23)		-75*** (22)
No SCard, Carded GP		-33*** (8.5)		-5.4* (2.9)		-14 (14)		-11 (17)		-4.6 (13)
No Info SCard, Carded GP		.33 (20)		-5.9 (3.7)		-109*** (13)		-128*** (15)		18 (13)
Not Carded GP	4.9 (13)	5 (13)	-7.4 (5)	-7.4 (5)	8.4 (16)	6.6 (16)	23 (22)	20 (22)	-14 (19)	-13 (19)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week FE	No	No	Yes	Yes	No	No	No	No	No	No
BL GP Mean	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
p-value: carded GP = not carded GP	<.001***		.46		.9		.35		.39	
p-value: Have SC = No SC			.88	.67		<.001***		<.001***		.0019***
Adj R-squared	.1	.1	.17	.17	.046	.095	.057	.13	.04	.051
Control Mean	112	112	34	34	127	127	146	146	-20	-20
N. of cases	10120	10120	14213	14213	5107	5107	5107	5107	5107	5107
Level	Indiv.	Indiv.	Indiv-Week	Indiv-Week	Hhd	Hhd	Hhd	Hhd	Hhd	Hhd

Users strongly prefer Smartcards to the status quo

NREGA



SSP



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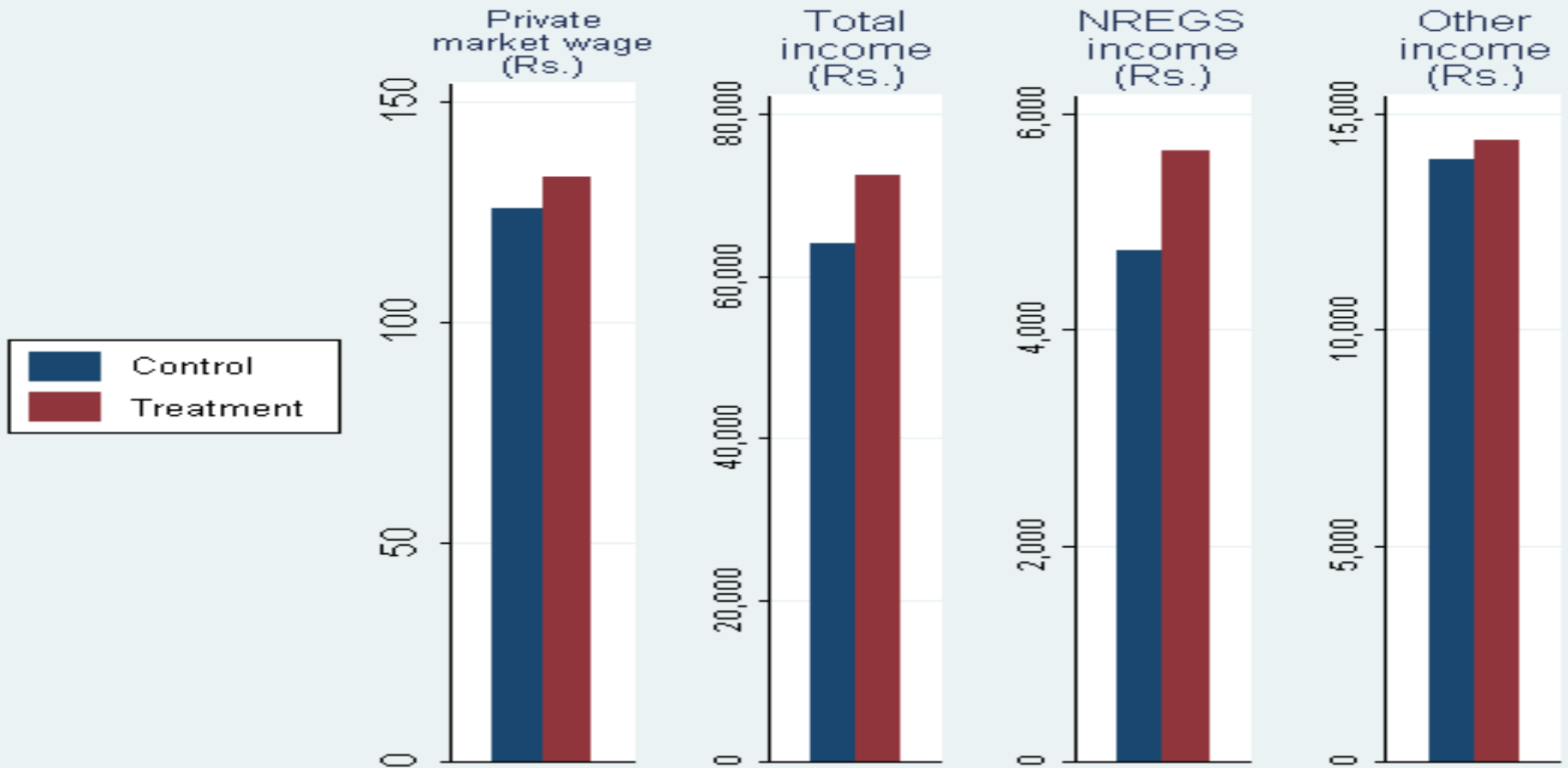
Pricing impacts

- Real cost of administration: 2% of (converted) payments, gross of savings on status-quo
- Efficiency effects
 - Reduced time collecting payments
 - (Reduced variability of payment lags)
- Redistributive effects: *directionally* positive but can only be quantified by taking a stand on welfare weights
 - Shorter payment lags moves float: from banks to beneficiaries
 - Reduced NREGS leakage: from corrupt officials to beneficiaries/government
 - Reduced SSP leakage: from corrupt officials/illegitimate beneficiaries to beneficiaries/government

Smartcards are cost-effective

Concept	Metric	NREGS	SSP	Total
Costs	2% of payments in converted GPs	\$4.05	\$2.25	\$6.30
Efficiency gains	Time savings	\$4.49	-	\$4.49
	Predictability	?	-	?
Redistribution	Float	\$0.40	-	\$0.40
	Leakage	\$38.54	\$3.15	\$41.70

[General equilibrium impacts even bigger]



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Lessons Learned

1. Smartcards appear to have significantly improved the ability of the government to implement NREGS (and SSP) as intended
 - Less leakage, more work done, more access to work, easier and faster payments
 - Improvements spread across distribution, and practically everyone prefers Smartcards over status quo
 - Time savings alone justify costs in the case of NREGS; large reductions in leakage
 - Improvements in program performance were large enough to generate GE effects (next paper!)
2. Our data do not capture potential future gains from services built on Smartcards infrastructure
 - For public sector programs (e.g. food security alternative)
 - As “public infrastructure” for private sector products (e.g. savings products, remittances)
3. Investments in state capacity in LDCs may have large returns relatively quickly (even with incomplete implementation)



Thank you



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