2ND ANNUAL RICHARD GOODE LECTURE

ESTHER DUFLO

The Economist as Plumber:
Laying the Pipes, Fixing the Leaks

Based on work by/with Abhijit Banerjee, Clement Imbert, Michael Greenstone, Santhosh Mathew, Karthik Muralidharan, Paul Niehaus, Nick Ryan, Rohini Pande Sandip Sukhtankar,

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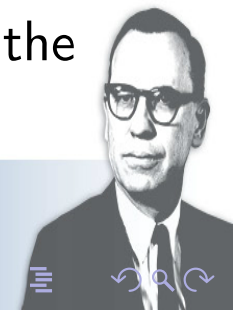
The (IMF?) Economist as plumber

- Most of the criticisms of the IMF have centered on the appropriateness of the Washington consensus.
- But the key issue in my view is not whether it is appropriate
- It is that general principles are insufficient as a guide to policy.
- Examples
  - Good governance.
  - Democracy
  - Don't waste public funds
  - Control entitlement programs
- What policy makers need is precise guidance on how to act on these ideas.
- Most corruption advice focuses on direct incentives of civil servants, but ignores the impact that the rules of the game can have.

Example 1: Fixing the pipes– The plumbing of public finances

- A principle of good governance that people have highlighted is decentralized implementation of public programs
- But this poses a plumbing problem: how to transfer money from the central government to the local implementing bodies?
- Historically, given poor communications and financial infrastructure, reliance on cash-based management system based on advances, not expenditures.
- This creates two issues:
  - Delay between fund transfer and justification of fund usage create leakage opportunities; accountability structures don't necessarily improve things
  - Money must sit around waiting to be used, which increases the budget deficit



Reforming the fund flow for the MGNRES program

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- It has suffered from massive corruption.
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- In this context, in collaboration with MORD, we implemented and evaluated on a large scale a reform of state fund flow.

Initial reforms: Audit and e-governance

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- In response several states - including Bihar - tightened audits
  - June 2011: the Bihar rural development department began requiring weekly audits of ongoing and completed works
  - November 2011: Clarified that MGNREGS public database be used to sample projects and additional MGNREGS documentation be made available to team in field
  - Between June 2012-13: 64% of GPs in our sample districts were audited at least once.
- In 2010, Bihar introduced an e-platform - Central Planning Scheme Monitoring Scheme (CPSMS) - to monitor account balances. Also created common state pool of funds and opened Zero Balance accounts for districts.

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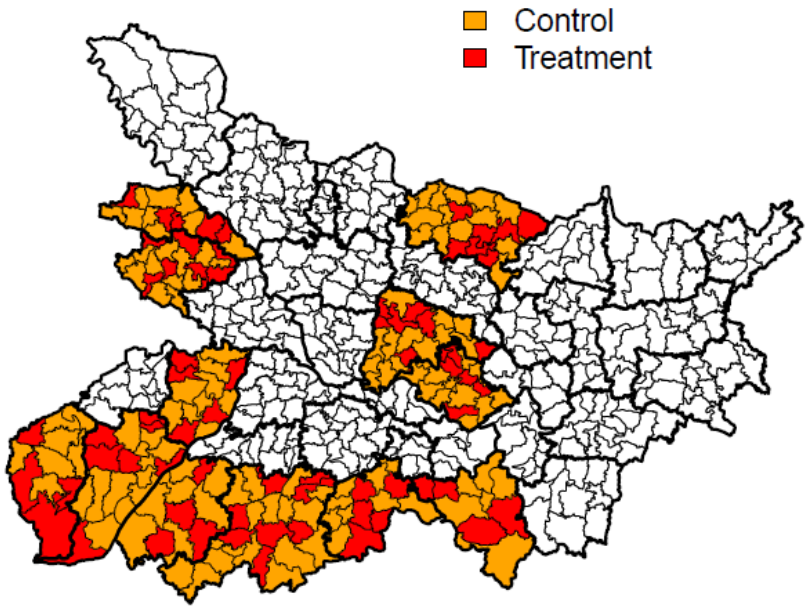
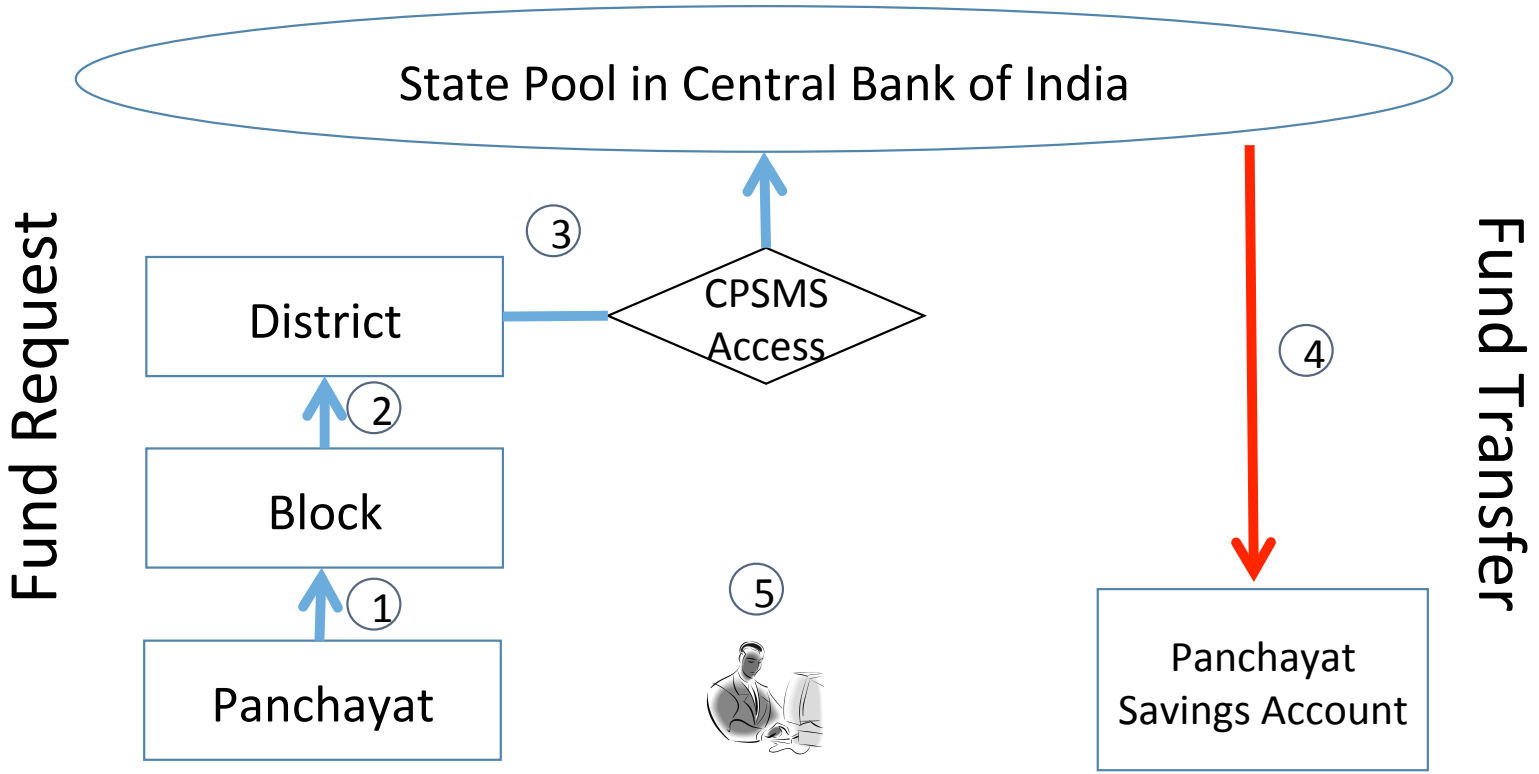
- Throughout, final stage of payments (from GP account to workers) unchanged.

Sample

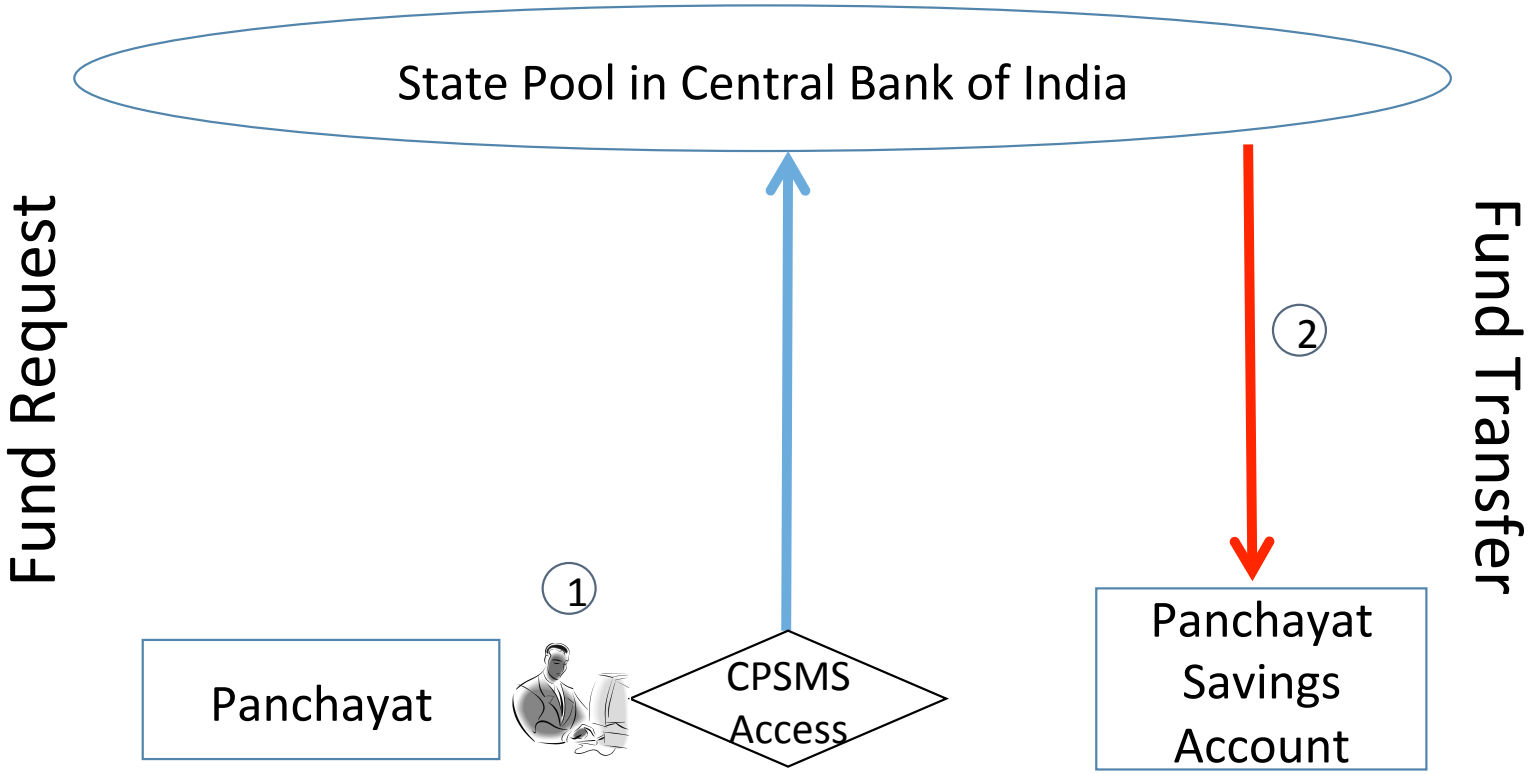


12		Districts
69T	126C	Blocks
1002T	2029C	GP

Fund Flow of Expenditures in Control



Fund Flow of Expenditures in Treatment (Labor Payments only)



How the reform can affect transparency

- Status quo: data entry of worker details lags work done by many months.
- Reform: realtime worker entry $\Rightarrow$ audit possible sooner
- We analyzed data from government audits
  - On average one audit per block per month.
  - For projects audited immediately after experiment, detection of malfeasance is 5 pp larger (or double) in T than in C.

Timeline

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  - Sept 18th: State Pool runs dry.
  - Dec 11th: State Pool replenished.
  - Dec 15th-end Dec: Strike of GP Personnel

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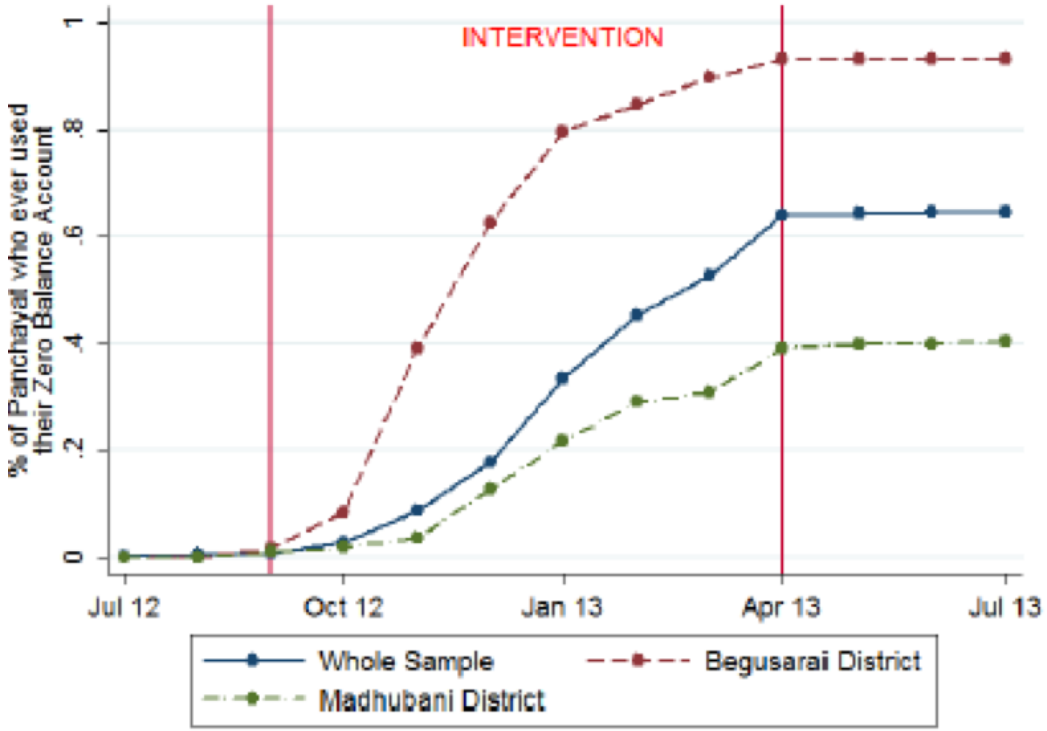
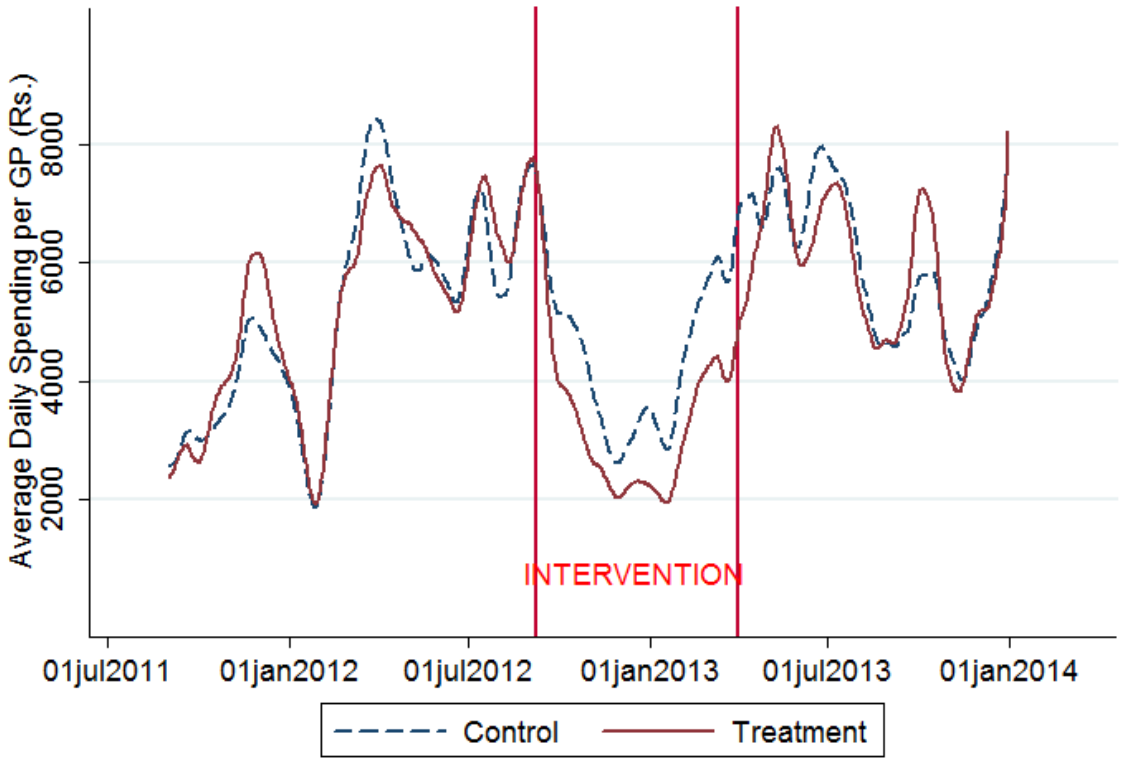
- April 1st 2013: Intervention is rolled back.
- May 15th - July 15th 2013: Endline survey

Program Take-up

Figure 5: Fraction of Treatment Panchayat which used CPSMS at least once



Decrease in Spending (CPSMS)



Source: CPSMS Credit and Debit data.

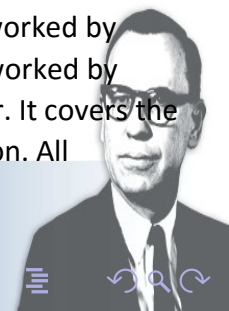
Estimated effect = Rs 230,000 per GP for total of 4.1 million USD

Using nrega.nic.in we see slightly higher number: Rs. 330,000 per GP

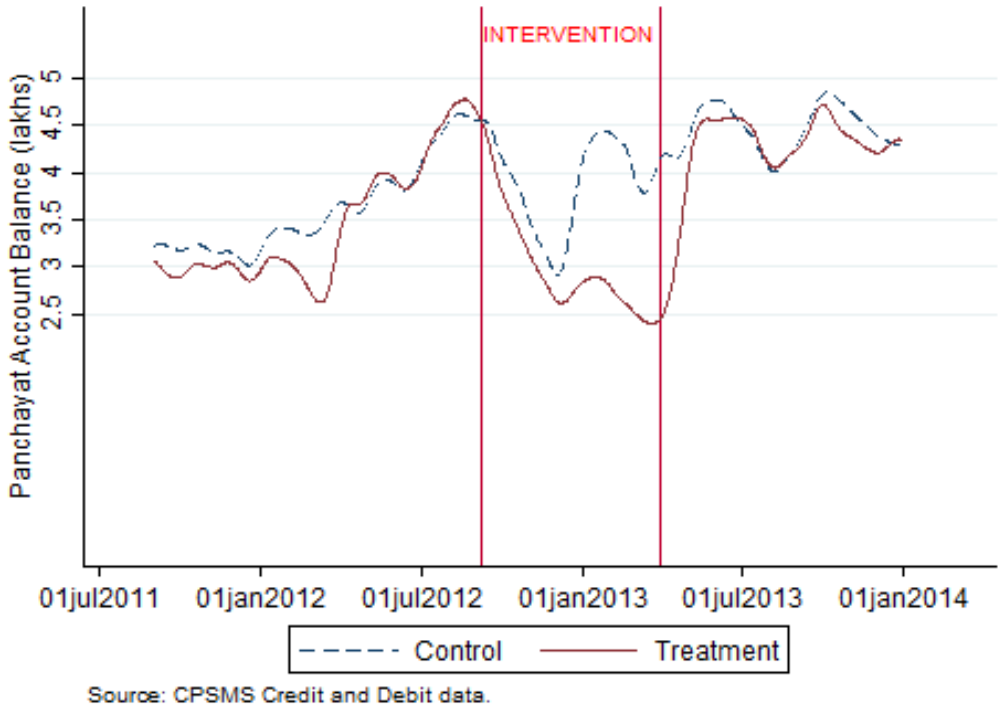
Correspondingly: Decline in reported employment

	Pre intervention	Set up	Intervention Period			Post intervention
	April 2011 - June 2012	July-August 2012	Sept-Dec 2012	Jan - Mar 2013	Whole Period	Apr 2013 - March 2014
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Days worked (nrega.nic.in)						
Treatment	91.88	-130.3	-404.6*	-267.8	-672.4*	-859.5
	(530.3)	(111.5)	(227.6)	(163.3)	(363.6)	(542.7)
Observations	2,959	2,959	2,959	2,959	2,959	2,959
Mean in Control	10313	1058	2759	2269	5028	10603
Panel B: Days per working household (nrega.nic.in)						
Treatment	-0.0269	-0.712	-0.286	0.187	-0.00410	-0.308
	(1.010)	(0.605)	(0.805)	(0.701)	(0.930)	(0.838)
Observations	2,952	2,514	2,728	2,717	2,868	2,945
Mean in Control	36.85	17.35	29.14	25.14	33.65	39.54
Panel C: Number of working households (nrega.nic.in)						
Treatment	2.988	-3.132	-10.02	-8.342	-13.60*	-15.03
	(12.49)	(5.151)	(6.233)	(5.700)	(8.150)	(10.33)
Observations	2,959	2,959	2,959	2,959	2,959	2,959
Mean in Control	273.6	59.92	91.68	90.37	140.2	257.2

Note: The unit of observation is a Gram Panchayat (GP). In Panel A the dependent variable is the total number of days provided. In panel B the dependent variable is the total number of days provided to households reported to have worked. In panel C the dependent variable is the number of households reported to have worked. In panel D the dependent variable is the number of days worked by households who could not be matched with survey households. In Panel E the dependent variable is the number of days worked by households matched with survey households. The data was extracted from Job card information on the nrega.nic.in server. It covers the period from July 2011 to Sept 2013. Treatment is a dummy which is equal to one for the blocks selected for the intervention. All specifications include district fixed effects.



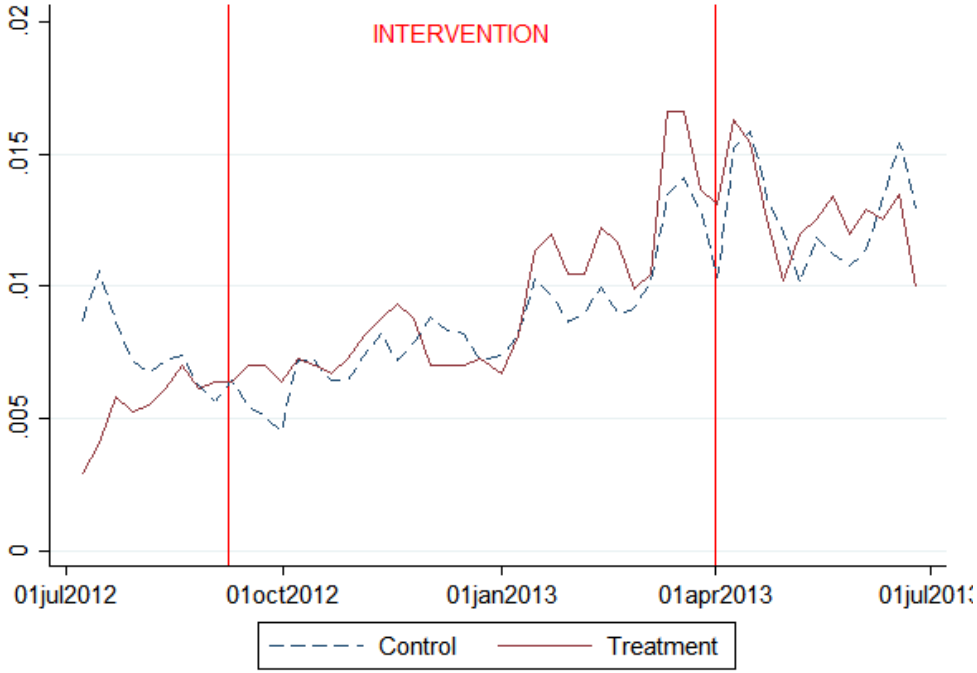
Balance in GP Accounts



Source: CPSMS Credit and Debit data.

Over the course of the project, the center credited *USD 6.3 million* less to GPs in the treatment group

No change in employment (Household Survey)



Source: Household survey (May-July 2013)

No change in projects built

	Number Registered		Fraction Found	
	All	On-going	All	On-going
Treatment	0.0494	-0.210	0.0172	0.0125
	(0.263)	(0.413)	(0.0179)	(0.0204)
Observations	390	390	3,872	3,241
Mean in Control	13.82	11.62	0.850	0.847

Source: MIS and MGNREGS Asset survey (May-July 2013)
Standard errors are clustered at the block level

Results Summary

- 25% Drop in GP Expenditure: 4.1 million USD in total.
- Drop in funds parked in GP account
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- Can we find direct evidence of less leaky pipes?

Ghost Busters?

Matching the census and the NREGA data base

- NREGA Job Cards Data
  - 18,513 villages across 195 blocks within 12 districts (6 Million names)
  - Registration number, name, husband/father name, age, etc.
- SECC Census Data
  - 16,480 villages across 195 blocks within 12 districts (33 Million Names)
  - Name, father name, age, etc.
- Goal is to determine for each household in the job cards data whether there is a matching household in the census data (person with the same name in the same village)

Ghost Busters

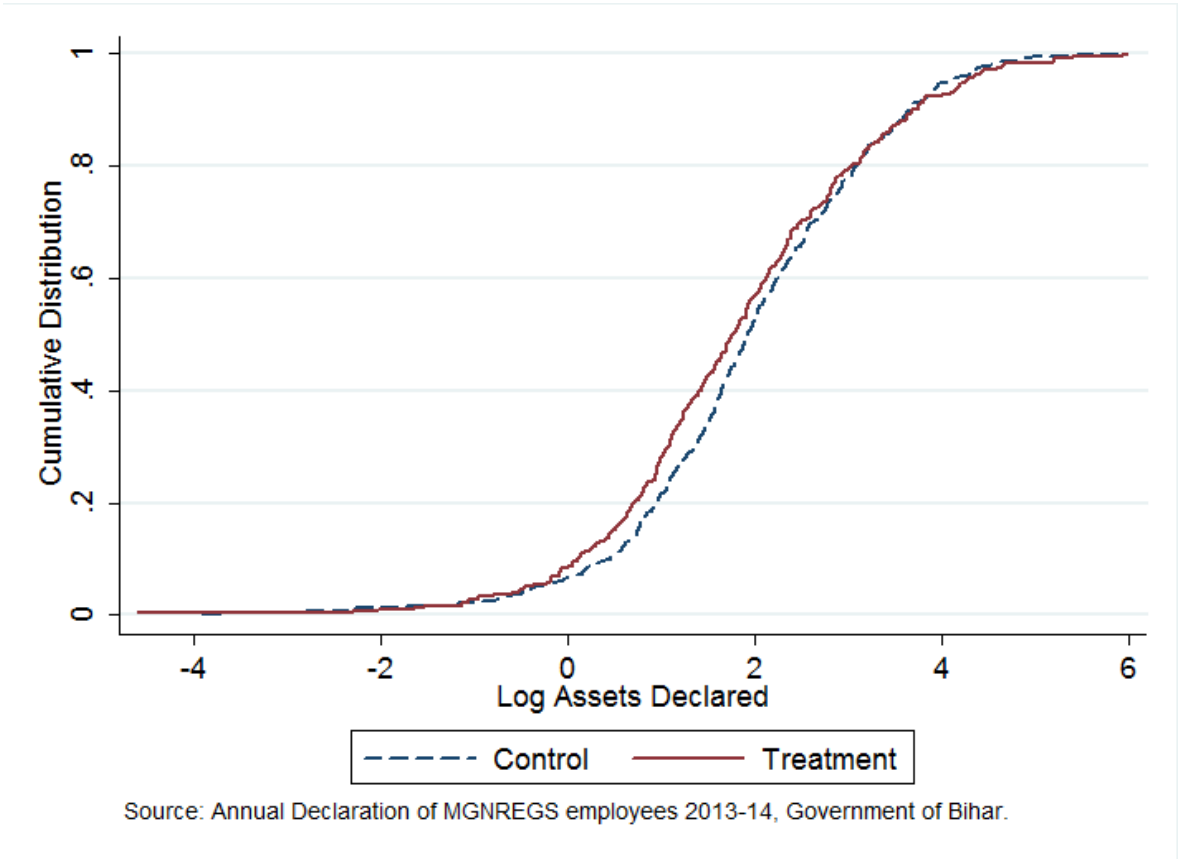
- Overall we match a bit over 50% of working households during the intervention period.
- Low, but similar to another calculation for leakage: number of working household estimated from our survey, divided by NREGA count: 60%.
- Program reduce fraction of ghost working household by 5%.

	All job cards	Job cards with at least one working member	
		Intervention period	Post intervention
	(as of April 2014)	(July 2012-March 2013)	(Apr 2013 - March 2014)
	(1)	(2)	(3)
Panel A: Match Rate for job cards with one member only			
Treatment	0.0187**	0.0181**	0.0107
	(0.00741)	(0.00766)	(0.00696)
Observations	3,095	2,868	2,922
Mean in Control	0.644	0.673	0.698
Panel B: Match Rate for job cards with two members or more			
Treatment	0.0135**	0.0126	0.0104
	(0.00613)	(0.00764)	(0.00732)
Observations	3,093	2,836	2,906
Mean in Control	0.243	0.282	0.286

Impact on Functionaries' Wealth

- Beginning in 2012, Functionaries who had worked on MGNREGS were required to report their assets
- Examine functionaries declared assets (2012-13 (before and during) and 2013-14 (just after))
- This data is self reported (first and second round): some caution needed
- It has been used before for elected official and some evidence that it has bite (Fisman, Schulz, Vig, 2015, 2016)

Decline in assets of block and GP officials in the middle of the distribution



Source: Annual Declaration of MGNREGS employees 2013-14, Government of Bihar.

Kolmogorov smirnoff test of stochastic dominance= p=0.057

Epilogue

- The reform reduced dormant funds and reduced leakage (through a decline in expenditure, not an increase in actual delivery).
- This was done on a very large scale, in difficult circumstances.
- Initial phase posed technical problems which increased delays, but things improved after a few months

Epilogue

- The reform reduced dormant funds and reduced leakage (through a decline in expenditure, not an increase in actual delivery).
- This was done on a very large scale, in difficult circumstances.
- Initial phase posed technical problems which increased delays, but things improved after a few months
- However... at the end of the fiscal year system was discontinued.
  - Combination of concerns on increased payment delays and reduced fund flow, and complaints from district officials,
  - Difficult for state officials to disentangle whether lowered expenditure meant more unmet demand or less leakage.
  - No constituency was in favor: people see no benefits, officials see reduction in bribes:

Epilogue (2)

- This year the reform was approved for nationwide rollout in MGNREGS, combined with direct payment to beneficiaries
- There is also an effort to expand the expenditure-based system to other centrally sponsored programs
  - The Government of India spends roughly 50 billion USD annually on Centrally Sponsored Schemes (CSS)
- June 2016: India's Ministry of Finance issued orders to extend the use of Public Financial Management System for all CSS and emphasized the need to facilitate expenditure based (just-in-time) financing

Example 2 – Changing the faucet: Biometric payment for benefits in India: Murlidharan et al (2014)

- Evaluates introduction of biometric smart card for payment of NREGA and pension
- under status quo: payment is done at post office. Lots of opportunities for leakage, e.g. village official goes with the person's passbook, collect their entire payment, and only give them a part.
- new system: biometric smart card, network of (female) bank employees who handle the cash payment with mini ATMs
- Randomized roll out across 158 subdistricts (19 million people).
- partial implementation: 50% of payment after roll out (like our program)

People get paid faster and with less delay

Table 2: Access to payments

	Time to Collect (Min)				Payment Lag (Days)			
	(1)	(2)	(3)	(4)	(5) Average	(6) Average	(7) Deviation	(8) Deviation
Treatment	-21**	-21**	-5.6	-2.8	-7.1*	-10***	-2.9***	-4.7***
	(9.3)	(8.7)	(5.3)	(5.6)	(3.8)	(3.6)	(1.1)	(1.5)
Carded GP								
BL GP Mean		.08*		.22***		-.027		.043
		(.041)		(.069)		(.09)		(.054)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fe	No	No	No	No	Yes	Yes	Yes	Yes
Adj R-squared	.06	.08	.06	.11	.14	.31	.07	.17
Control Mean	112	112	77	77	34	34	12	12
N. of cases	10252	10181	3814	3591	14279	7254	14279	7254
Level	Indiv.	Indiv.	Indiv.	Indiv.	Indiv-Week	Indiv-Week	Indiv-Week	Indiv-Week
Survey	NREGS	NREGS	SSP	SSP	NREGS	NREGS	NREGS	NREGS

Less leakage

Table 3: Official and survey reports of program benefits

(a) NREGS

	Official		Survey		Leakage	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	9.9	7.6	35**	35**	-25*	-27**
	(12)	(12)	(15)	(15)	(13)	(13)
BL GP Mean		.12***		.11***		.089**
		(.027)		(.037)		(.038)
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	.03	.05	.05	.06	.03	.04
Control Mean	127	127	146	146	-20	-20
N. of cases	5179	5143	5179	5143	5179	5143

Less stealing from specific people (as expected)

(a) NREGS

	Ghost households		Other overreporting		Bribe to collect	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-.011	-.011	-.082**	-.083**	-.0021	-.0028
	(.02)	(.021)	(.033)	(.036)	(.0088)	(.0092)
BL GP Mean		-.013		.019		.014
		(.067)		(.043)		(.018)
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	.02	.02	.05	.04	.01	.01
Control Mean	.11	.11	.26	.26	.021	.021
N. of cases	5314	5278	3984	3703	10437	10366
Level	Hhd	Hhd	Hhd	Hhd	Indiv.	Indiv.

More use of the program

Table 5: Access to programs

	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	.075**	.074**	-.025	-.031	.026*	.023	-.00016	-.00038
	(.033)	(.033)	(.027)	(.033)	(.015)	(.015)	(.0015)	(.0015)
BL GP Mean		.14***				-.023		-.0056**
		(.037)				(.027)		(.0027)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	.05	.06	.10	.10	.02	.02	.00	.00
Control Mean	.42	.42	.2	.42	.035	.035	.0022	.0022
N. of cases	4978	4944	4783	4531	4790	4750	7232	6908

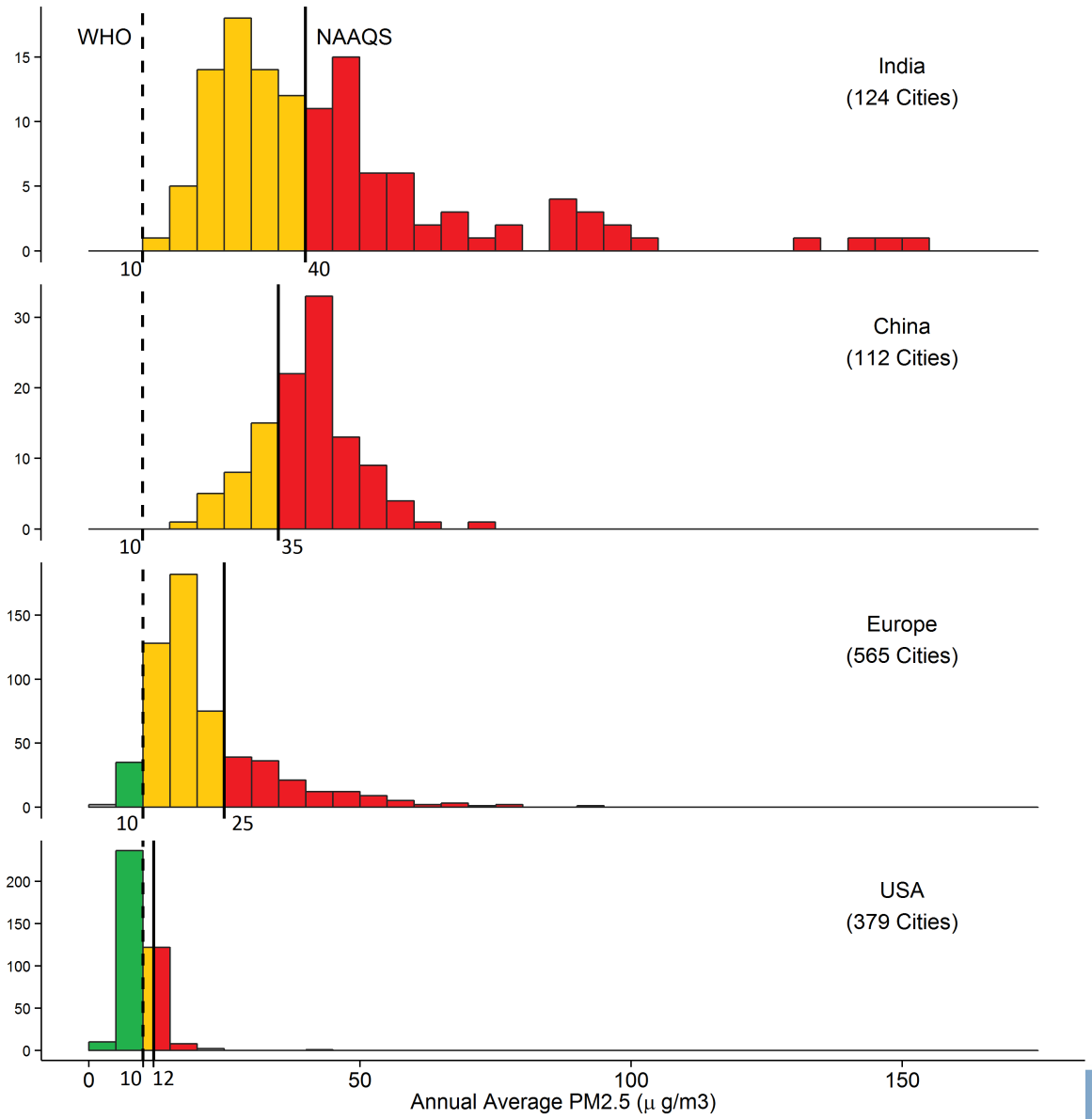
Interpretation

- More transparency in program implementation
- Better service at the final step
- Unlike in the case of the ‘pipes’ reform, there was little push back by program officials apparently
- Perhaps because reform was voluntary and partial (leaves the option to steal from the "ghosts")
- Also in this case there was a direct benefit to beneficiaries. In the pipes reform, all the benefits flew to the government.
- It shows the importance of better customer service, not just fighting corruption.

Example 3: Replacing the meter–Audit reform in Gujarat

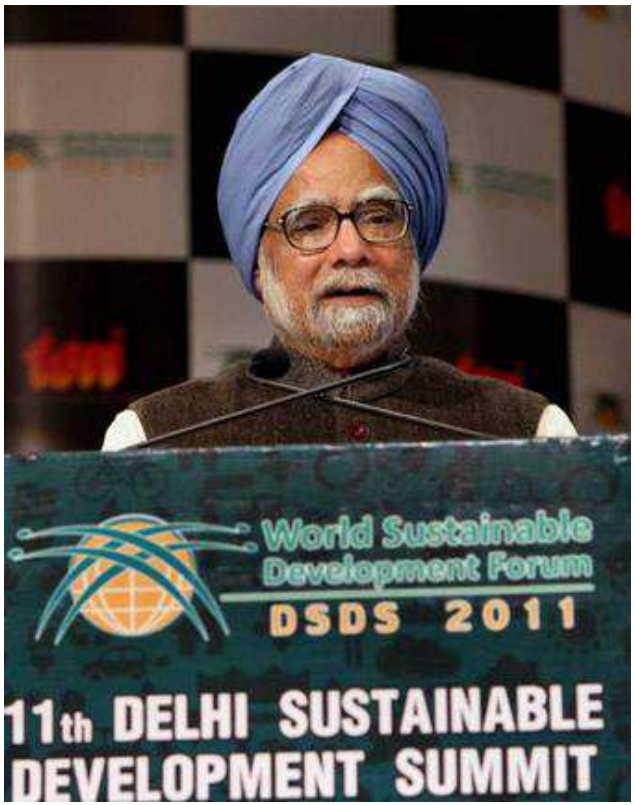
- The world just agreed to limit CO2 emissions, and India will play a major role
- Air quality in Delhi is so bad that the SC ordered the government to do something
- But how to enforce whatever decision is taken?

Figure: PM 2.5 Concentrations Around the World



Environmental Regulation: The constraint

Figure: Manmohan Singh



I must emphasise that standards are not enough. They must also be enforced which is often difficult. . . . It is also necessary to ensure that these regulatory standards do not bring back the License Permit Raj which we sought to get rid of in the wake of economic reforms of the nineties. Delhi Sustainable Development Summit, 2011.

Environmental Regulatory Design in India: Fixing the meter

- How can the regulator obtain reliable and relevant information on the units it regulates?
- Does better information lead to lower pollution?
- Designing third party information provision systems that work: "Truth-telling by Third-Party Auditors and the Response of Polluting Firms: Experimental Evidence from India" (with Greenstone Ryan and Pande), *QJE*, 2013.
- Is Regulatory discretion good or bad? "Rules Versus Discretion in Environmental Regulation: Experimental Evidence from Inspections of Polluting Plants (with Greenstone and Ryan and Pande), mimeo 2016.

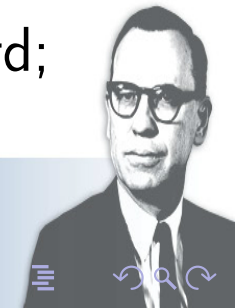
States Enforce Environmental Regulation in India

Standards at the national level

- Command-and-control regulations set at the national level by the Water Act (1974), Air Act (1981) and Environment Protection Act (1986)
- Main standards maximum allowable concentrations for emissions, which states can tighten but not relax
- Severe, criminal sanctions for violations

Enforcement at the state level

- State Pollution Control Boards (SPCBs) created with Water Act and responsibility, but not staffing, increased with each later Act
- Experiments conducted with Gujarat Pollution Control Board; ongoing work also in partnership with national ministry



Industrialization and Pollution Both High in Gujarat

Figure: Stacks in Surat

- 8% annual output growth since 1991-1992 and largest share of post-licensing reform investment of any Indian state
- State with most critically polluted industrial clusters (8), including 2 most polluted in the country: Vapi area among ten most polluted places on Earth in 2007 (groundwater mercury 96 times higher than WHO)
- 3 of India's 5 most polluted rivers and major cities in violation of National Ambient Air Quality Standards.

Inspections And Audits as Regulatory Tools

- Key objective: Provide regulator information on plant compliance with pollution standards
  - Inspections: Staff engineers and scientists visit plant, observe and sample water and air emissions. Information summarised in inspection reports
  - Audits: Third party auditors hired by firms provide regulator annual audit reports
- **Audits** Can private-sector involvement substitute for low state capacity? How should third-party audits be (re)designed to limit conflict of interest?
- **Inspections** Can a rule-based inspection assignment approach improve pollution compliance? What are the social costs and benefits of a rule-based system?

Third Party Auditing and Environmental regulation

Private third-parties have a growing place in environmental regulation

- Potential advantages of capacity/expertise, flexibility and cost.
- Support environmental standards like ISO 14001 and carbon offsets (Potoski and Prakash, 2005; Bhattacharyya, 2011).

But third-parties have mixed incentives

- Audited company hiring the auditor may create a conflict of interest for auditors needing to maintain their business.
- Many cases where audits have been unreliable. E.g. corporate accounting scandals or credit ratings during the financial crisis.

Audit reform

- Worked with regulator to evaluate audit reform at scale via a field experiment
- Audit treatment reforms three aspects of existing system on a pilot basis for 233 of 473 plants, mostly textile processing
  1. Random assignment of auditors and fixed payment from central pool (independence).
  2. Backcheck auditors on performance (monitoring).
  3. In year 2 of the experiment, additionally, auditors paid for accuracy relative to backchecks (accuracy incentives).

Final-outlet water and boiler-stack air samples

Figure: Water sampling

Figure: Stack sampling

Figure: Audit Readings for Suspended Particulate Matter (SPM)

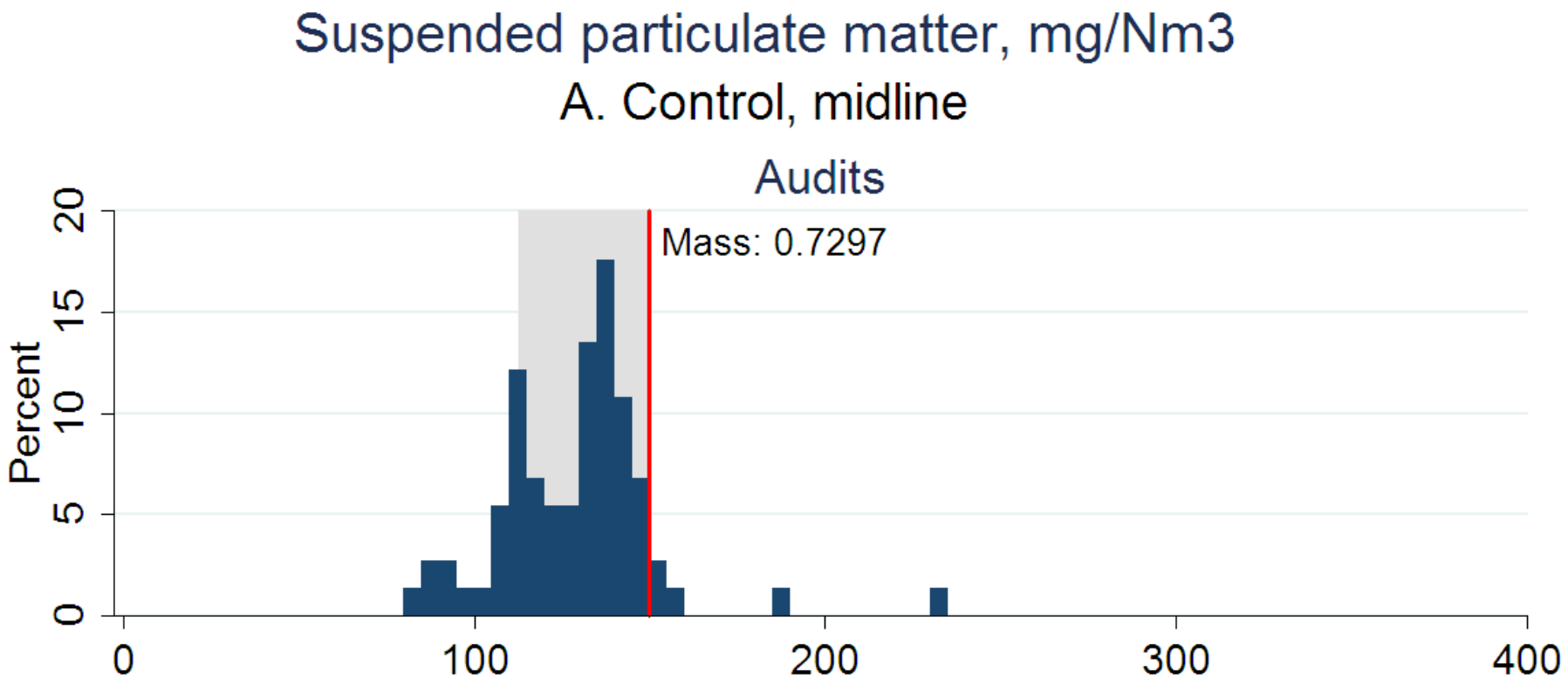


Figure: Audit Readings for Suspended Particulate Matter (SPM)

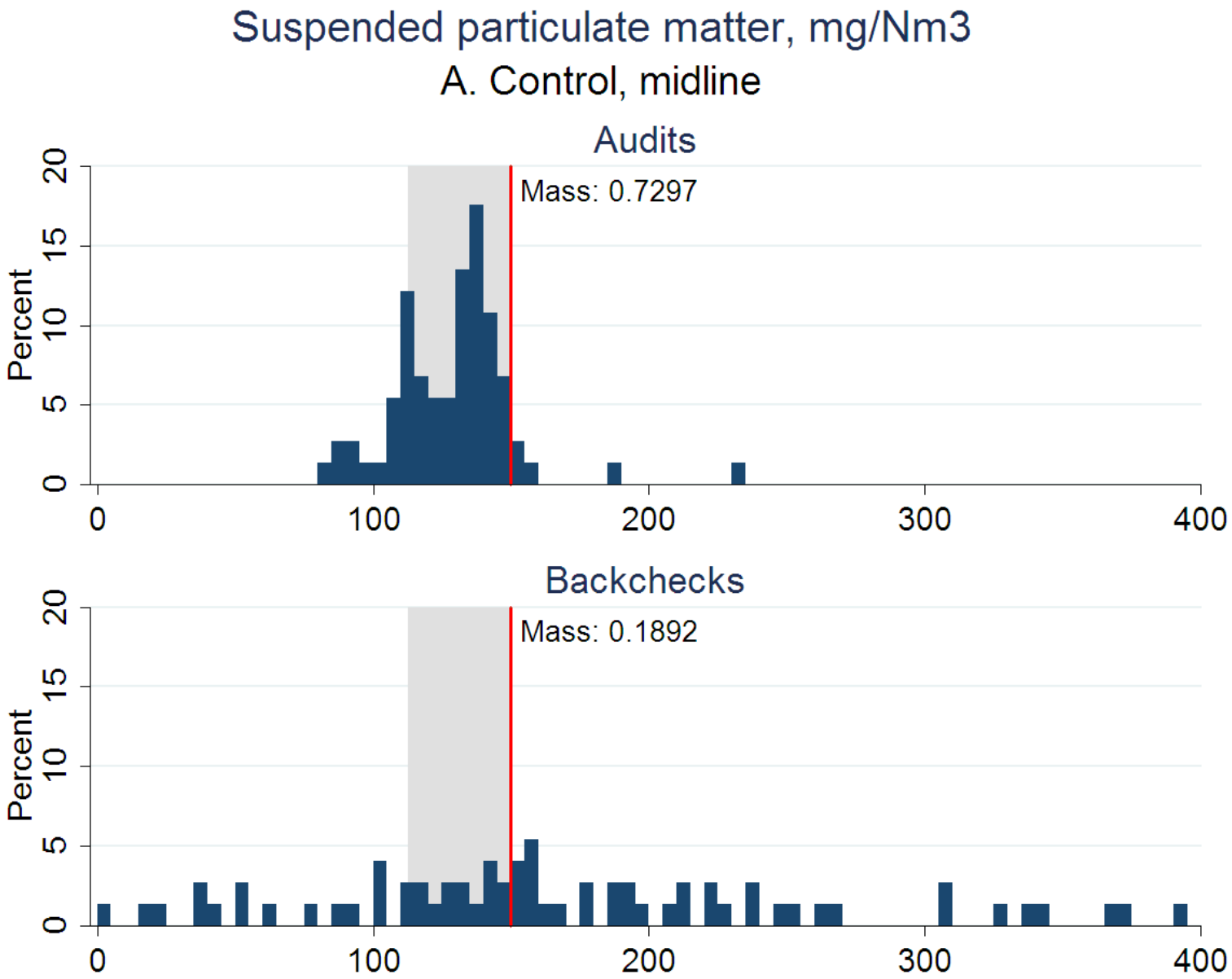


Figure: Audit Readings for Suspended Particulate Matter (SPM)

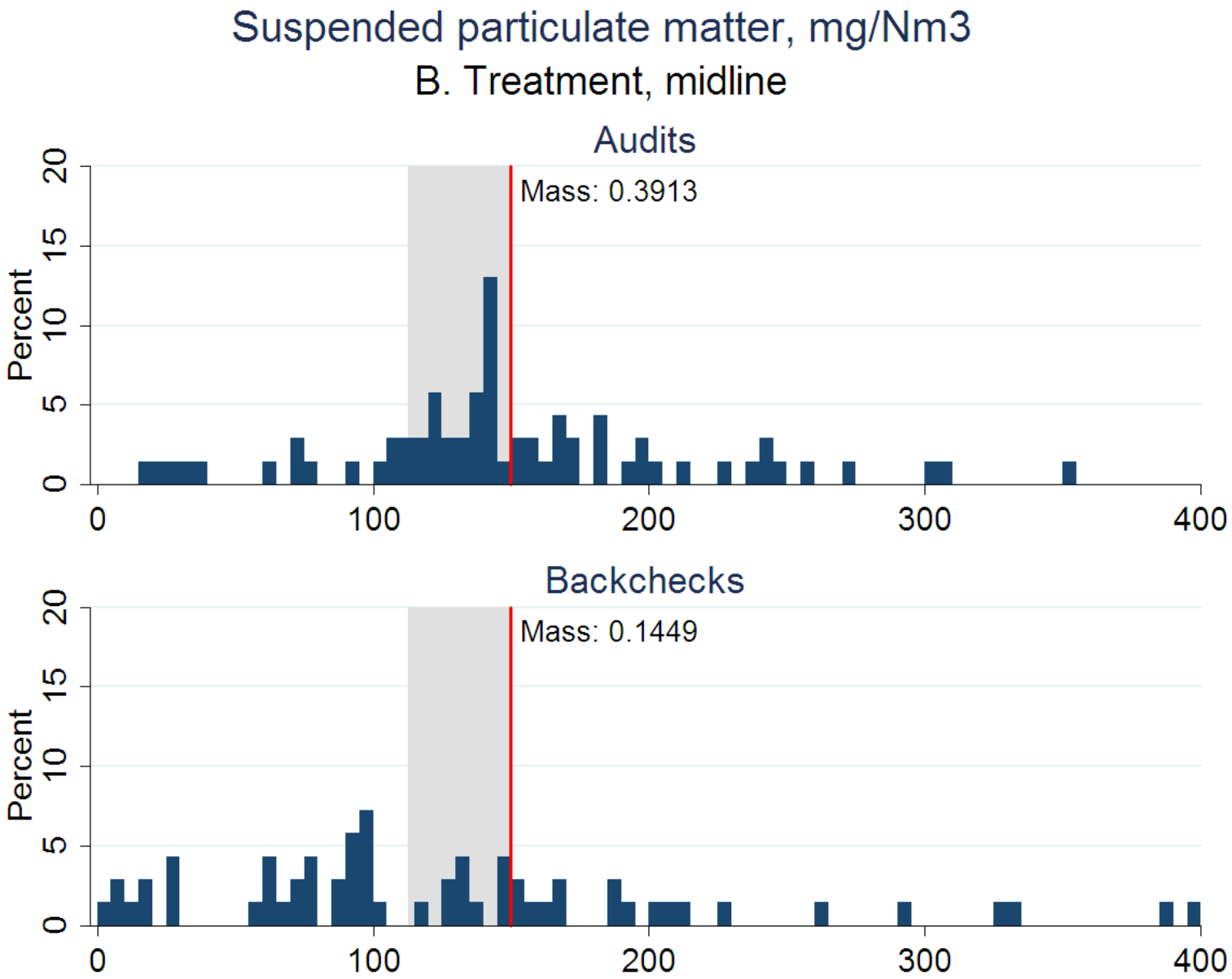


Figure: Quantile Regression Effects of Treatment on Endline Pollution

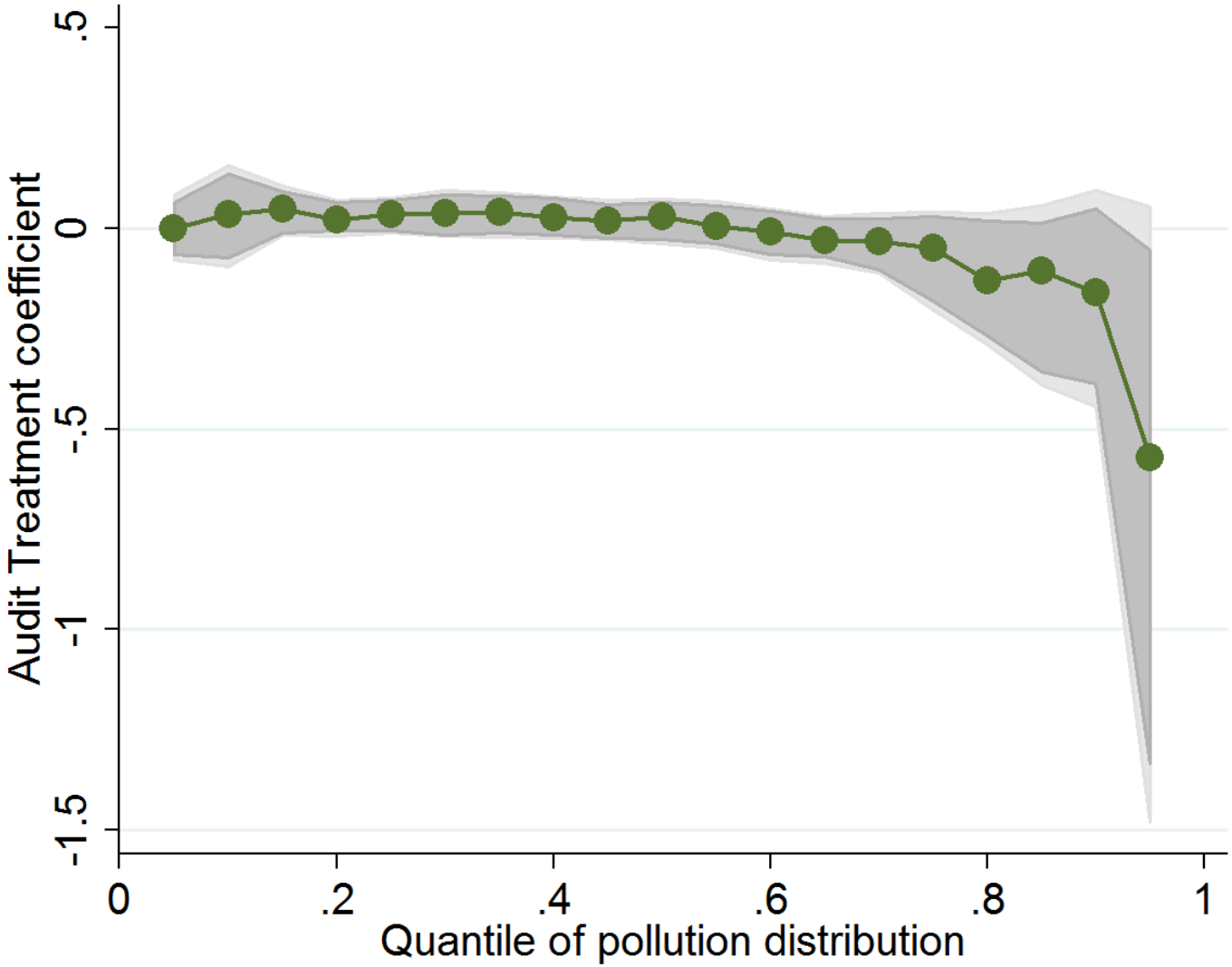
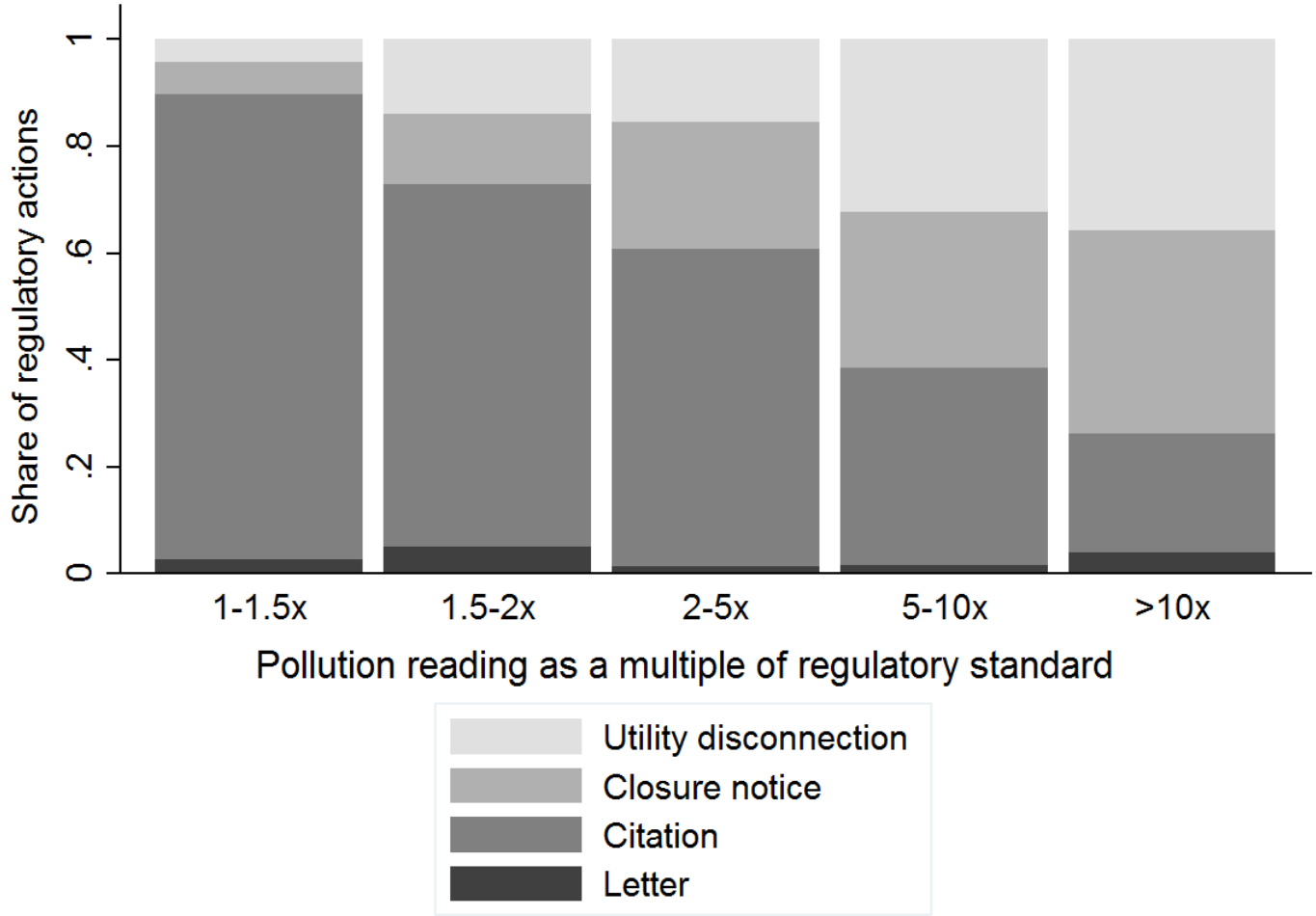


Figure: Response in Tail Reflects Likelihood of Penalty



Conclusion

- Plumbing problem is under-emphasized in discussing government effectiveness and state capacity
- We know a lot about how to effectively design the infrastructure of public policy (whatever the goal) but this knowledge is neither shared not put to work
- This can change, there is a lot of interest among governments of getting inputs to do what they want to do anyways more effectively.