You Get What You Pay For: Electricity Quality and Firm Response

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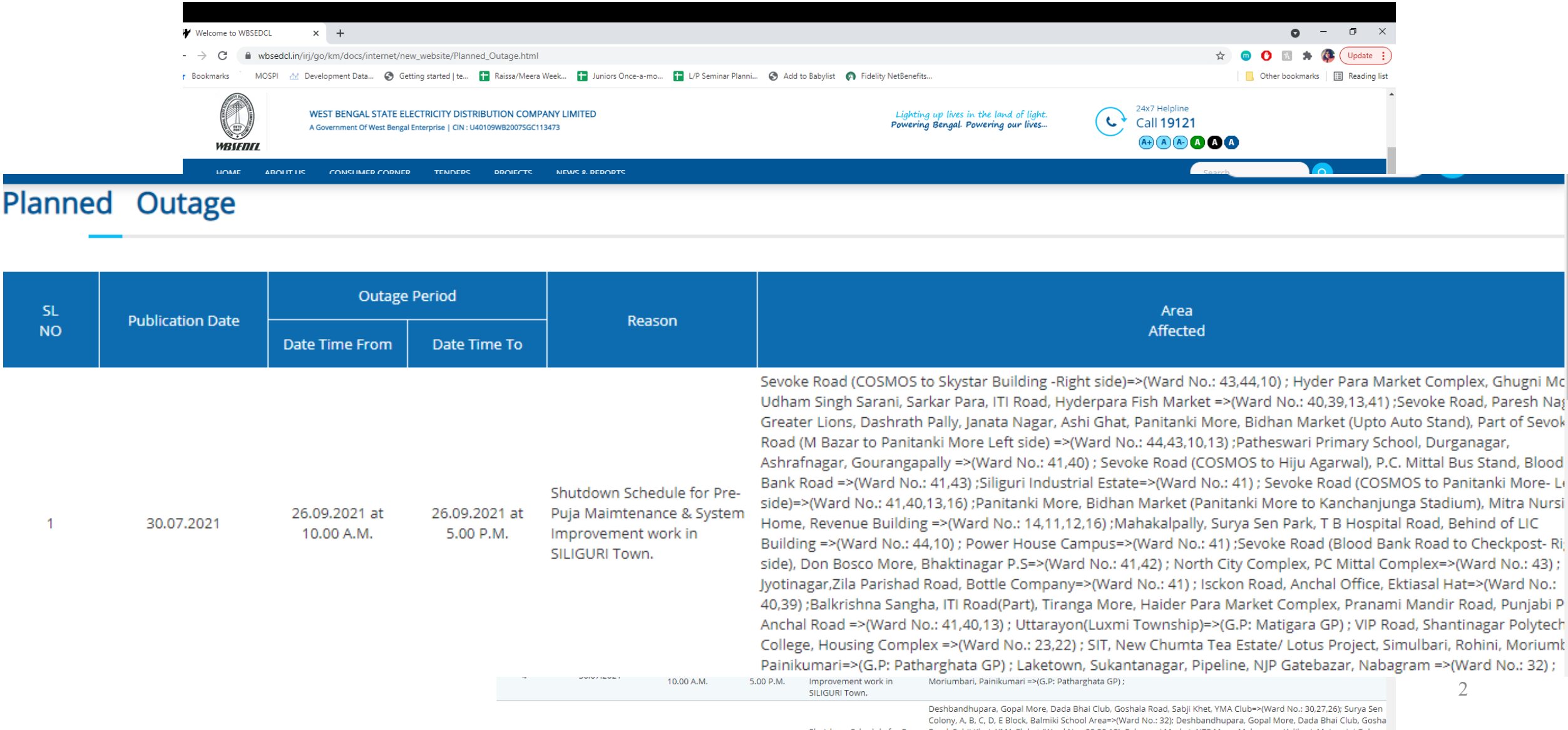
University of California, Irvine

December 17th, 2022

Blackouts are common in India



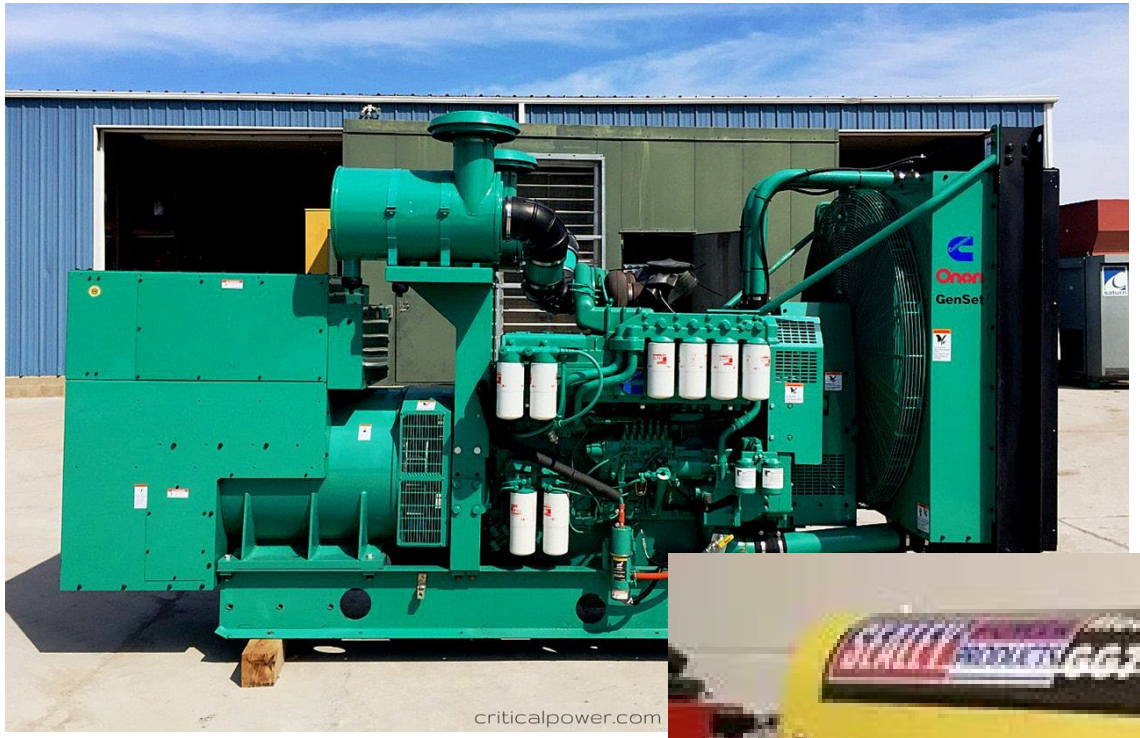
SL NO	Publication Date	Outage Period		Reason	Area Affected
		Date Time From	Date Time To		
1	30.07.2021	26.09.2021 at 10.00 A.M.	26.09.2021 at 5.00 P.M.	Shutdown Schedule for Pre-Puja Maimtenance & System Improvement work in SILIGURI Town.	Sevoke Road (COSMOS to Skystar Building -Right side)=>(Ward No.: 43,44,10) ; Hyder Para Market Complex, Ghugni Mo Udham Singh Sarani, Sarkar Para, ITI Road, Hyderpara Fish Market =>(Ward No.: 40,39,13,41) ;Sevoke Road, Paresh Nag Greater Lions, Dashrath Pally, Janata Nagar, Ashi Ghat, Panitanki More, Bidhan Market (Upto Auto Stand), Part of Sevok Road (M Bazar to Panitanki More Left side) =>(Ward No.: 44,43,10,13) ;Patheswari Primary School, Durganagar, Ashrafnagar, Gourangapally =>(Ward No.: 41,40) ; Sevoke Road (COSMOS to Hiju Agarwal), P.C. Mittal Bus Stand, Blood Bank Road =>(Ward No.: 41,43) ;Siliguri Industrial Estate=>(Ward No.: 41) ; Sevoke Road (COSMOS to Panitanki More- L side)=>(Ward No.: 41,40,13,16) ;Panitanki More, Bidhan Market (Panitanki More to Kanchanjunga Stadium), Mitra Nursi Home, Revenue Building =>(Ward No.: 14,11,12,16) ;Mahakalpally, Surya Sen Park, T B Hospital Road, Behind of LIC Building =>(Ward No.: 44,10) ; Power House Campus=>(Ward No.: 41) ;Sevoke Road (Blood Bank Road to Checkpost- Ri side), Don Bosco More, Bhaktinagar P.S=>(Ward No.: 41,42) ; North City Complex, PC Mittal Complex=>(Ward No.: 43) ; Jyotinagar,Zila Parishad Road, Bottle Company=>(Ward No.: 41) ; Isckon Road, Anchal Office, Ektiasal Hat=>(Ward No.: 40,39) ;Balkrishna Sangha, ITI Road(Part), Tiranga More, Haider Para Market Complex, Pranami Mandir Road, Punjabi P Anchal Road =>(Ward No.: 41,40,13) ; Uttarayon(Luxmi Township)=>(G.P: Matigara GP) ; VIP Road, Shantinagar Polytech College, Housing Complex =>(Ward No.: 23,22) ; SIT, New Chumta Tea Estate/ Lotus Project, Simulbari, Rohini, Moriumb Painikumari=>(G.P: Patharghata GP) ; Laketown, Sukantanagar, Pipeline, NJP Gatebazar, Nabagram =>(Ward No.: 32) ;

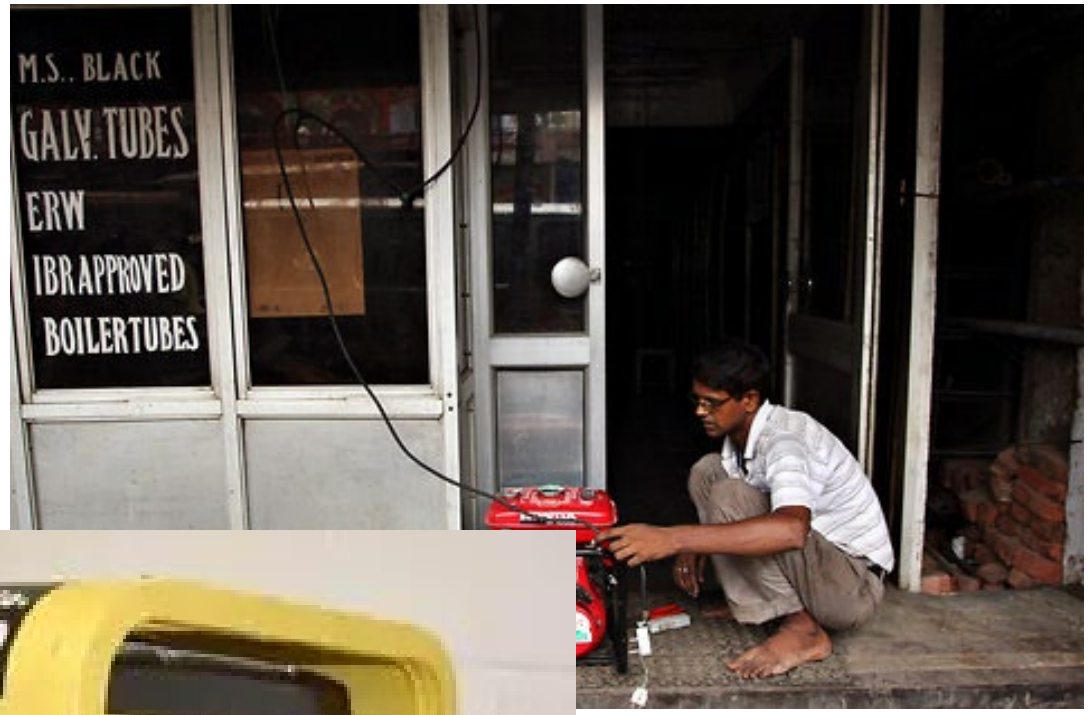
10.00 A.M. 5.00 P.M. Improvement work in SILIGURI Town. Moriumbari, Painikumari =>(G.P: Patharghata GP) ;

Deshbandhupara, Gopal More, Dada Bhai Club, Goshala Road, Sabji Khet, YMA Club=>(Ward No.: 30,27,26); Surya Sen Colony, A, B, C, D, E Block, Balmiki School Area=>(Ward No.: 32); Deshbandhupara, Gopal More, Dada Bhai Club, Gosha

Blackouts are common in India

- Firms report outages as a major constraint to manufacturing (World Bank ‘14)


Onan
GenSet
criticalpower.com


M.S.. BLACK
GALV. TUBES
ERW
IBR APPROVED
BOILER TUBES


GG2500

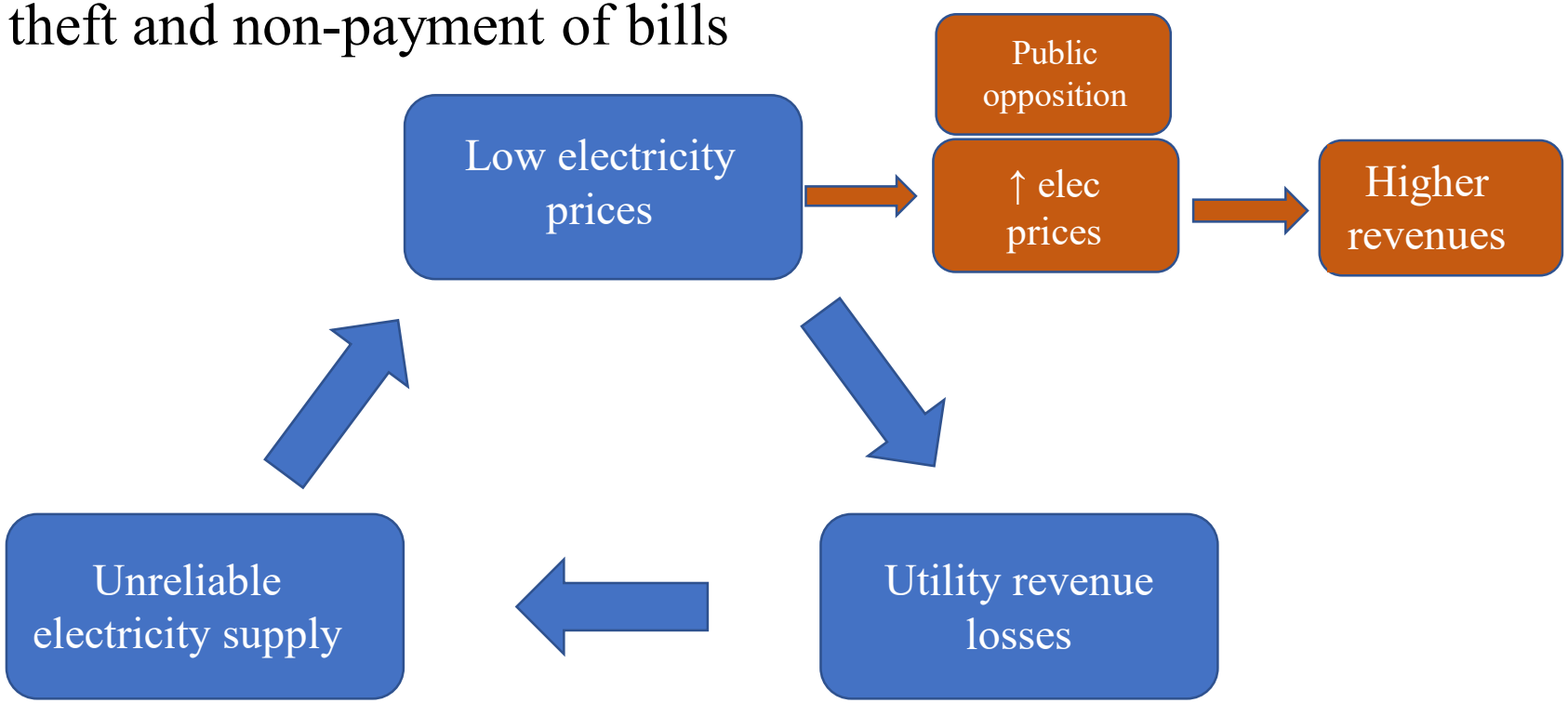
Blackouts are common in India

- Firms report outages as a major constraint to manufacturing (World Bank '14)
  - Firm productivity falls in the short-run (Fisher-Vanden et al. 2015)
  - Modest improvements significantly boost productivity (Alcott et al. 2016)
  - Could increase productivity by 25% in the long-run if improved (Fried & Lagakos '20)

- In India,
  - Electricity state-provided
  - Utilities systematically make financial losses & restrict supply (Burlig et al. 2020)
  - Low prices, theft, and patronage – perpetuated because of political reasons (Baskaran et al. 2015, Chatterjee 2020, Mahadevan 2021)

Paying more for electricity could lead to better outcomes

- Burgess et al. (2020): a bad equilibrium created by treating electricity as a right regardless of theft and non-payment of bills
- Vicious cycle



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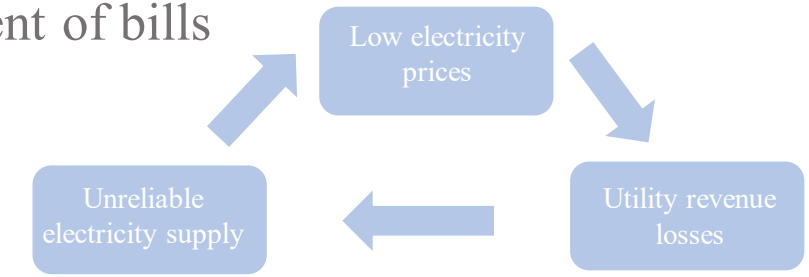


- **Research Question:** Can electricity reliability be improved in this setting? Will higher prices be accepted despite lobbies to keep it low?

- I leverage a 2003 national electricity reform policy to answer this question
  - Unbundling → separating generation, transmission & distribution
  - Different states implemented this policy differently, and in a staggered manner

Types of unbundling by state

Table A1: Different styles of restructuring in various states

States			
Type 1 Treatment 1	**Type 2 Treatment 2**	**Type 3 Treatment 3**	**No Unbundling Control Group**
Tamil Nadu	Maharashtra	Andhra Pradesh	Goa
Punjab	Meghalaya	Delhi	Jammu and Kashmir
Himachal Pradesh	Uttaranchal	Gujarat	Jharkhand
	Assam	Haryana	Kerala
	West Bengal	Karnataka	Manipur
	Chattisgarh	Madhya Pradesh	Nagaland
		Orissa	Sikkim
		Rajasthan	Tripura
		Uttar Pradesh	
		Bihar	

Type 1 Generation and distribution separated from transmission

Type 2 Generation, transmission and distribution separated, single distribution company

Type 3 Generation, transmission and distribution separated, multiple distribution companies

No Unbundling States that did not restructure during the study period

Event study design to causally estimate effects of reforms on mfg.

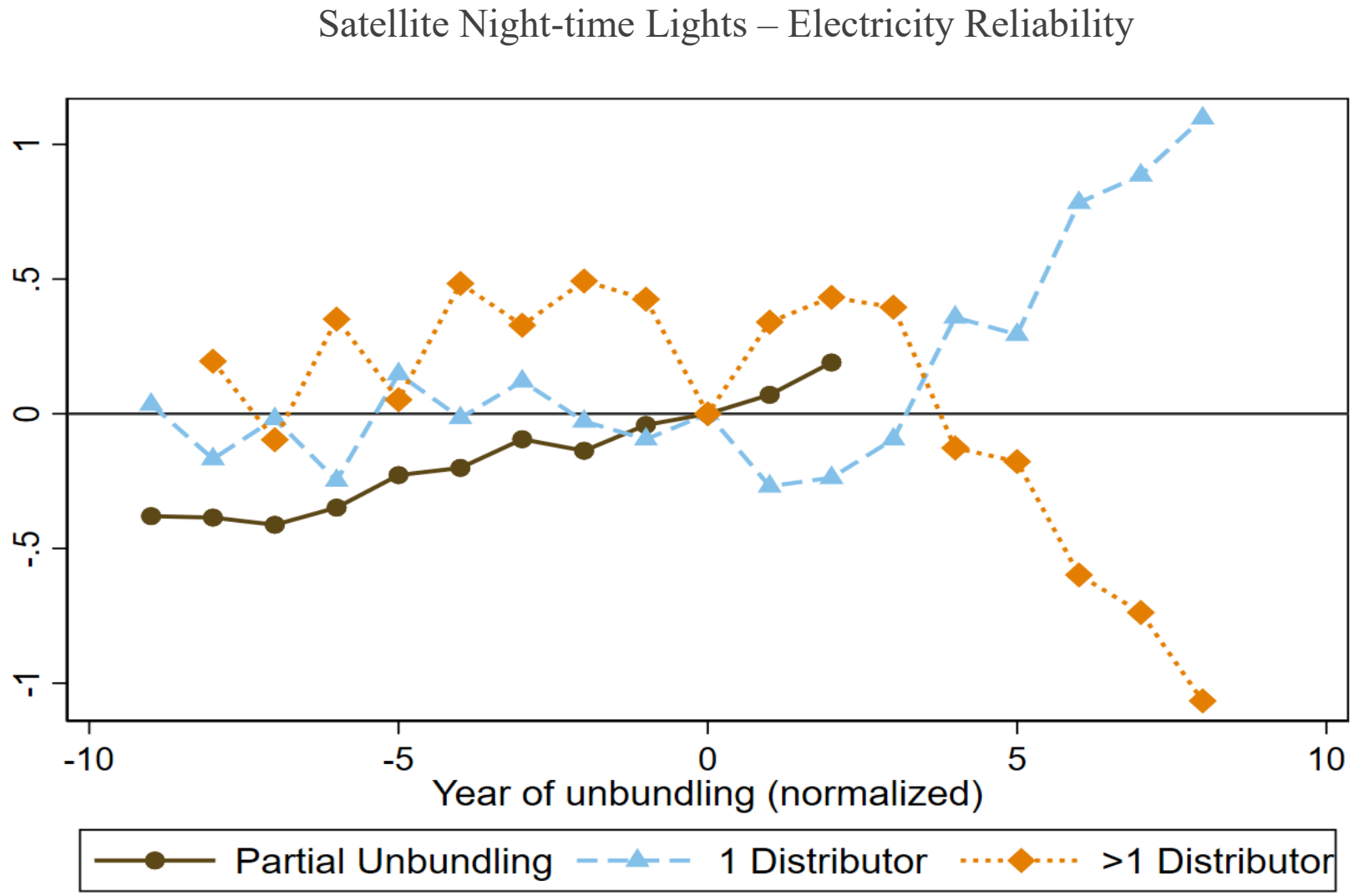
- Data
  - Annual Survey of Industries: 1998-2012
    - Examine electricity consumption, prices paid, own generation and productivity
  - DMSP-OLS Satellite Nighttime Lights 1998-2012
  - State-level electricity structure data collected from individual state sources

Event study design to causally estimate effects of reforms on mfg.

- Identification
  - Event study design (Cicala 2015, Cropper et al. 2011, Markiewicz et al. 2004)
    - Staggered entry diff-in-diff (Goodman-Bacon 2018; Callaway & Sant'Anna, Forthcoming; Sun and Abraham 2020; de Chaisemartin & D'Haultfuille, 2020).
  - Estimating the Average Treatment Effect on the Treated (ATT)
    - z: unbundling, y=year, s=state, i=industry, f=firm, Y=outcome variable, SERC=regulatory commission

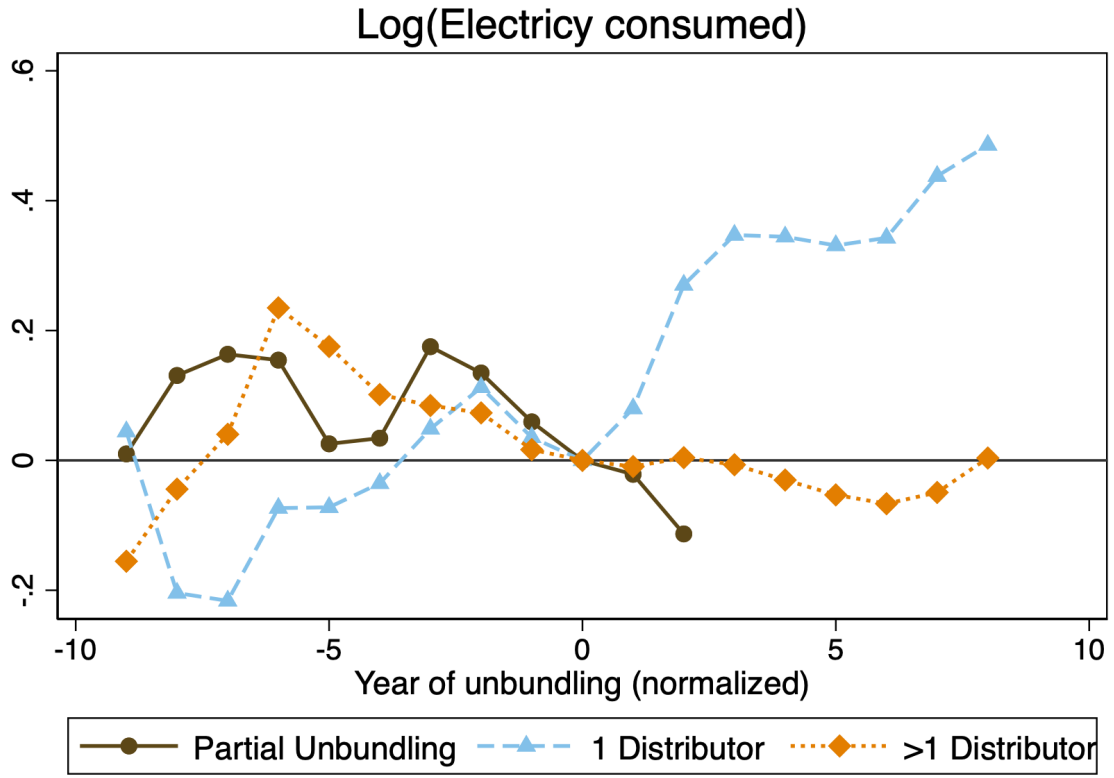
$$Y_{fist} = \sum_{z=1}^{3} \left[\sum_{y=-9}^{-1} \delta_{zy} Unbundled_{zs} \mathbb{1}(t - T_s = y) + \sum_{y=1}^{7} \delta_{zy} Unbundled_{zs} \mathbb{1}(t - T_s = y) \right]$$
$$+ SERC_{st} + \theta_s + \theta_t + \theta_i + \nu_{fist}$$

Reduced electricity blackouts – single distributor



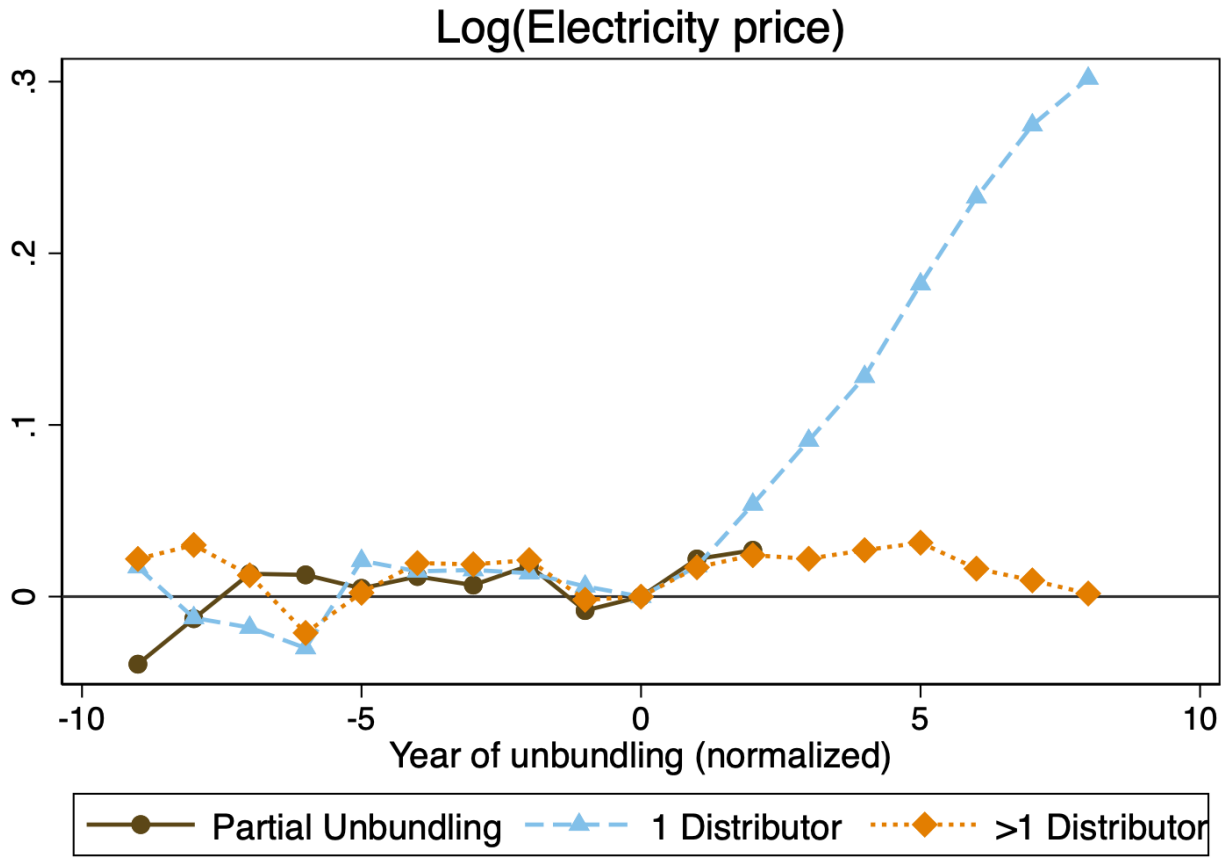
Electricity consumption went up…

- Electricity reliability ↑, evidence shows firms reported blackouts as an input constraint → it is no surprise that consumption ↑



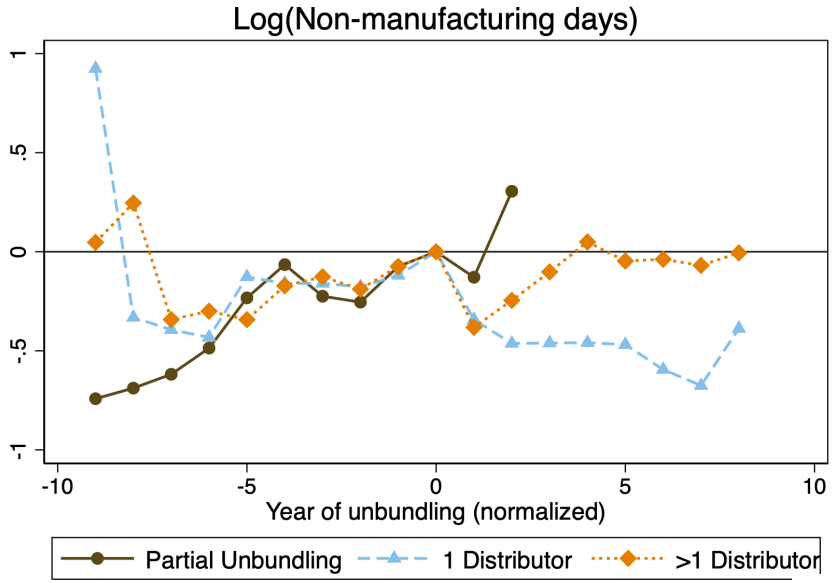
…Despite higher prices

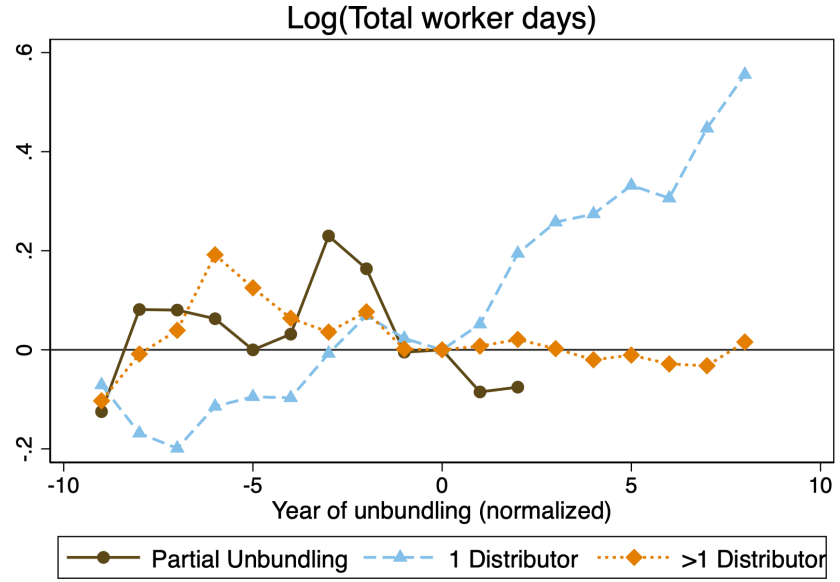
- Firms are willing to pay higher marginal prices in order to consume more

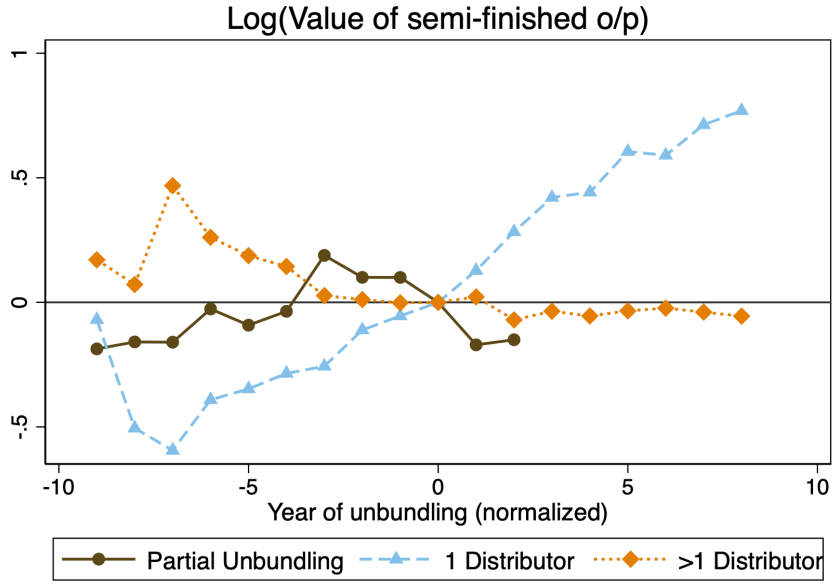


Confidence intervals

Firm and worker output go up

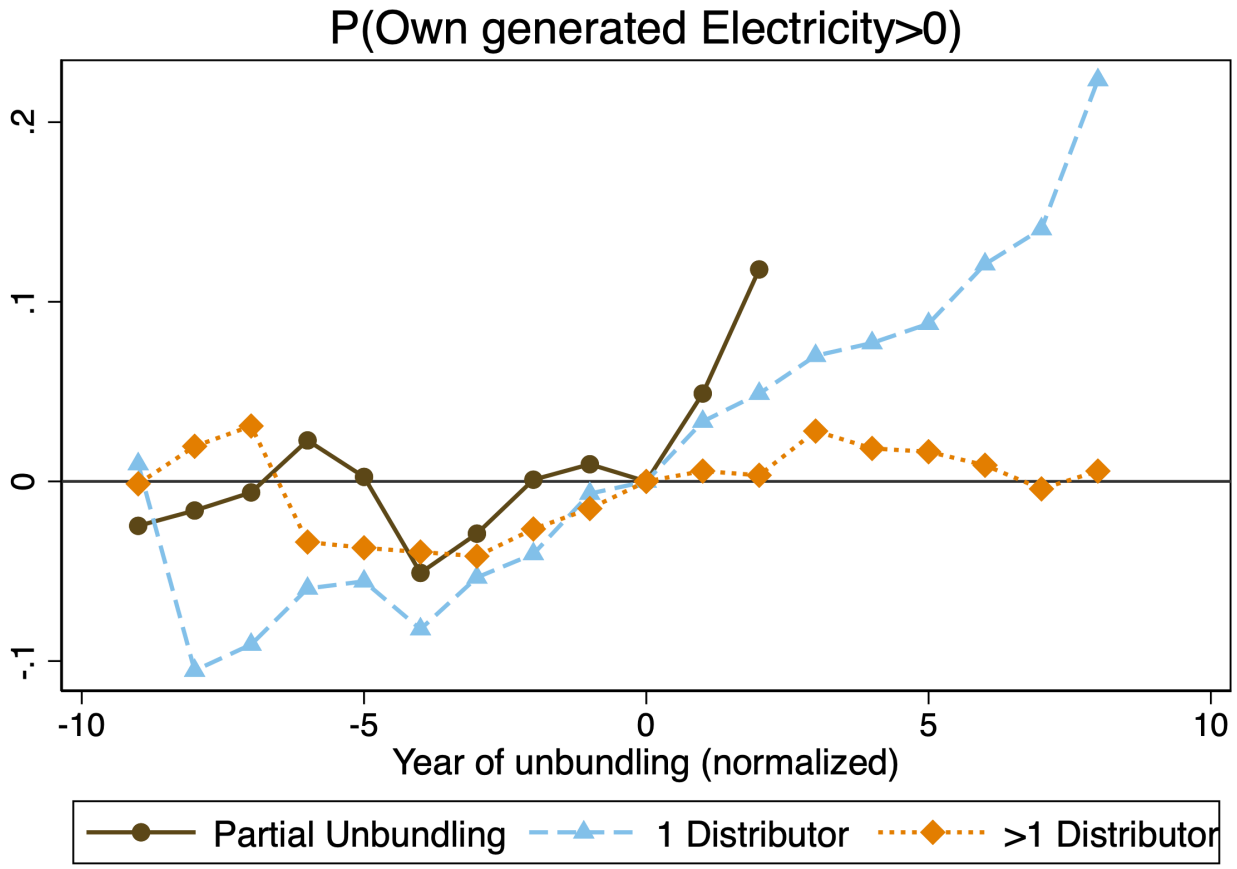


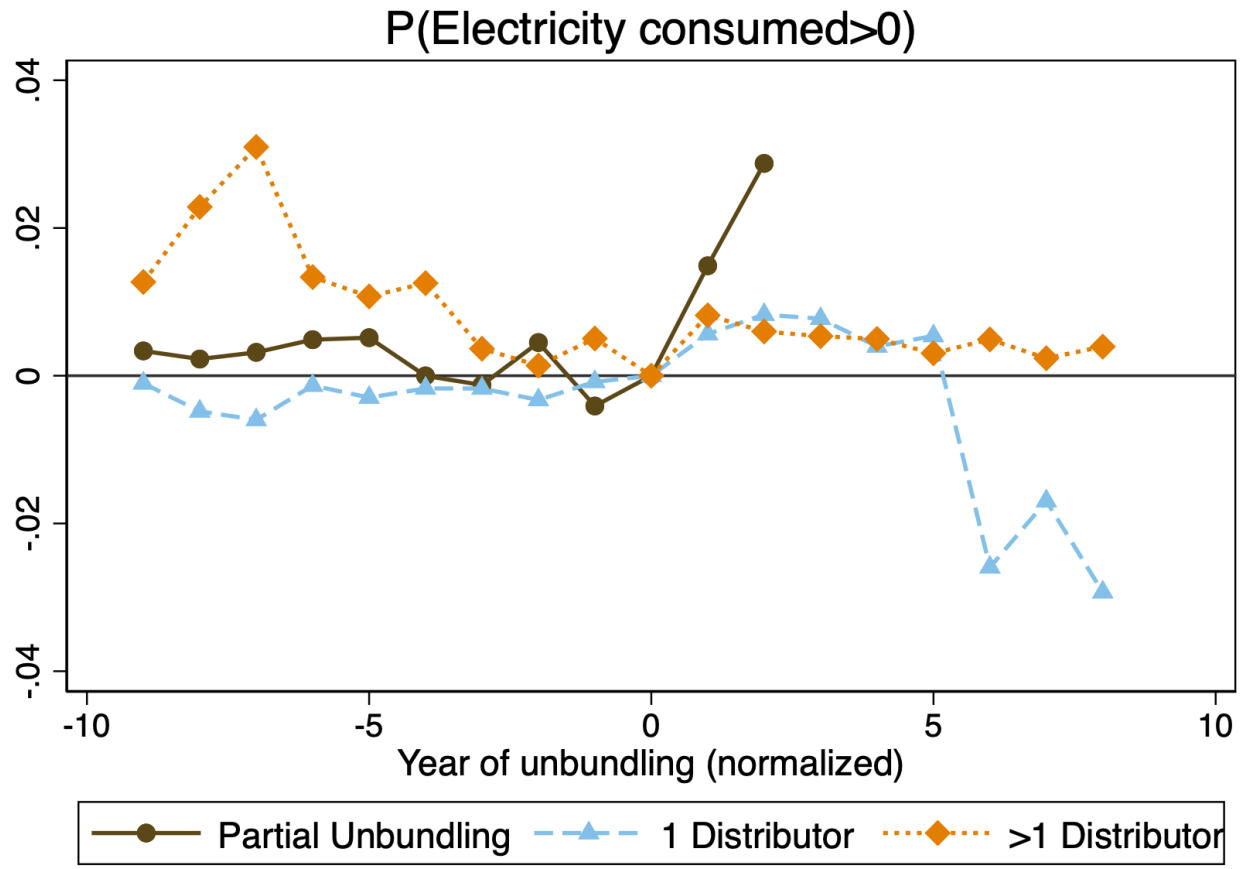




Confidence intervals

Small firms may be exiting, while larger firms re-optimize





Discussion

- Why did states with single distributors perform better?
  1. Higher accountability for single distributors → state-wide supply on single entity.
  2. Most states with single utility adopt progressive tariffs. Highest prices for industry: possibly easier to seek approval from regulatory bodies.
  3. Is corporate governance more effective in a single utility setting?
- Multiple utilities: cross-jurisdictional coordination & cooperation across multiple groups
  1. Multiple distributors have separate consumer bases: e.g. only agricultural, or only industrial, difficult to cross-subsidize.
  2. Does the worst performing utility determine the effective prices?
- While raising prices politically opposed, revealed preference by firms → acceptable when accompanied by higher reliability
- Demonstrating higher productivity despite higher prices crucial to redesigning price structure

Thank you!

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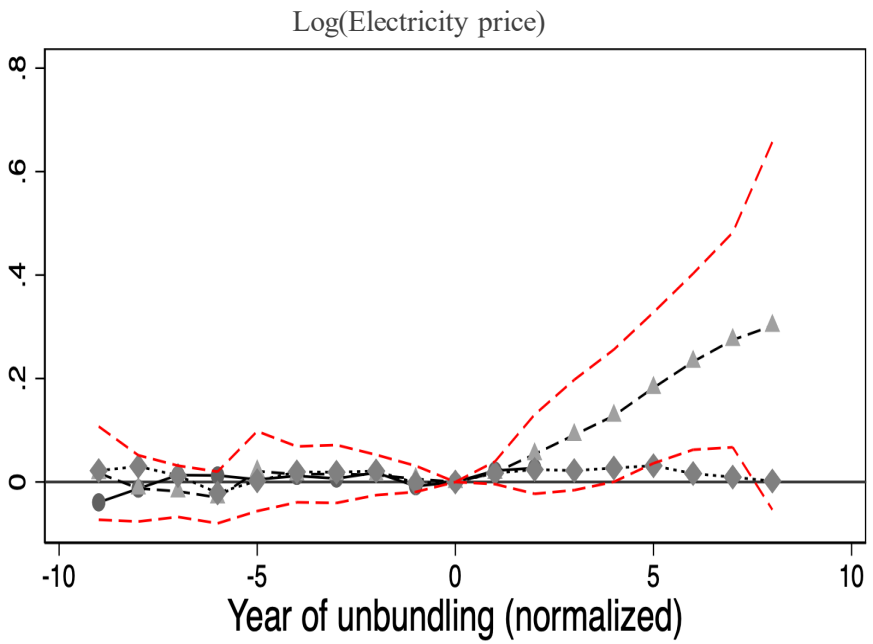
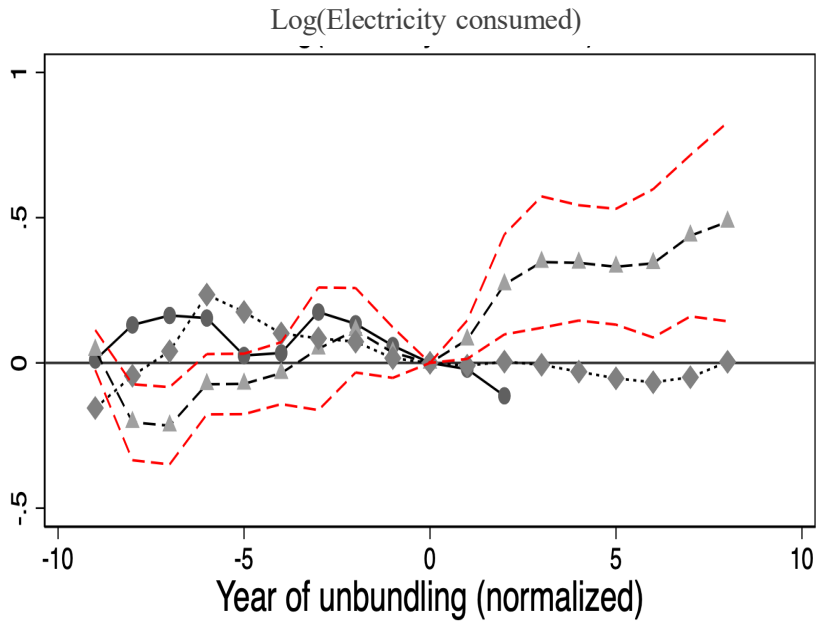
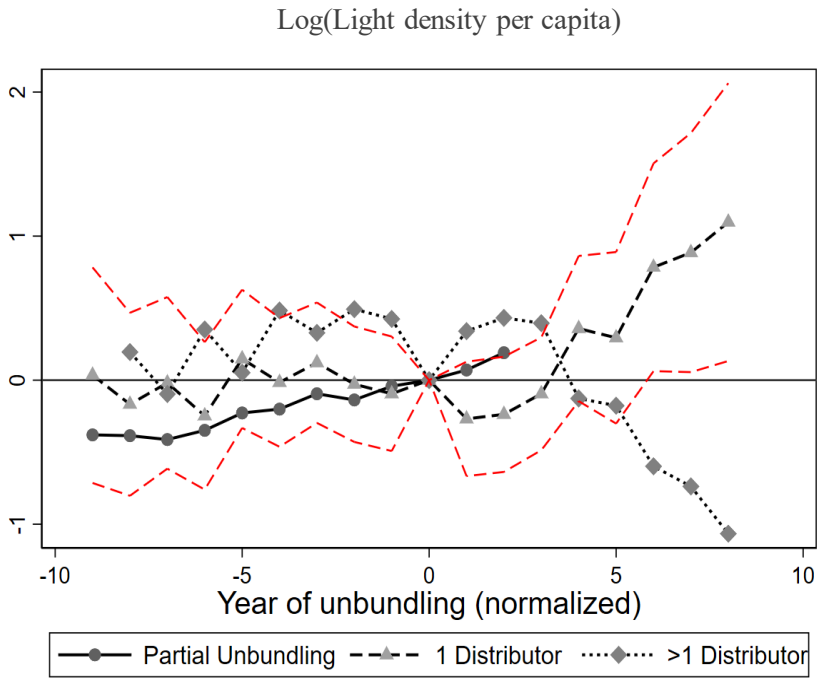
Effects on electricity consumption, price and reliability







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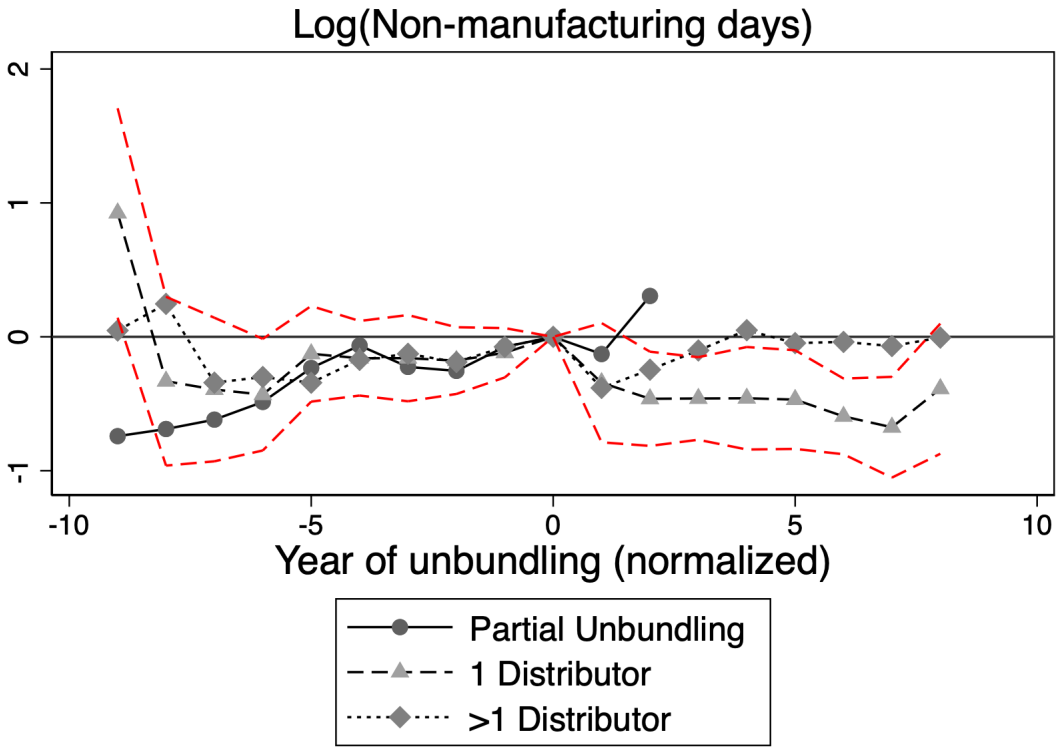
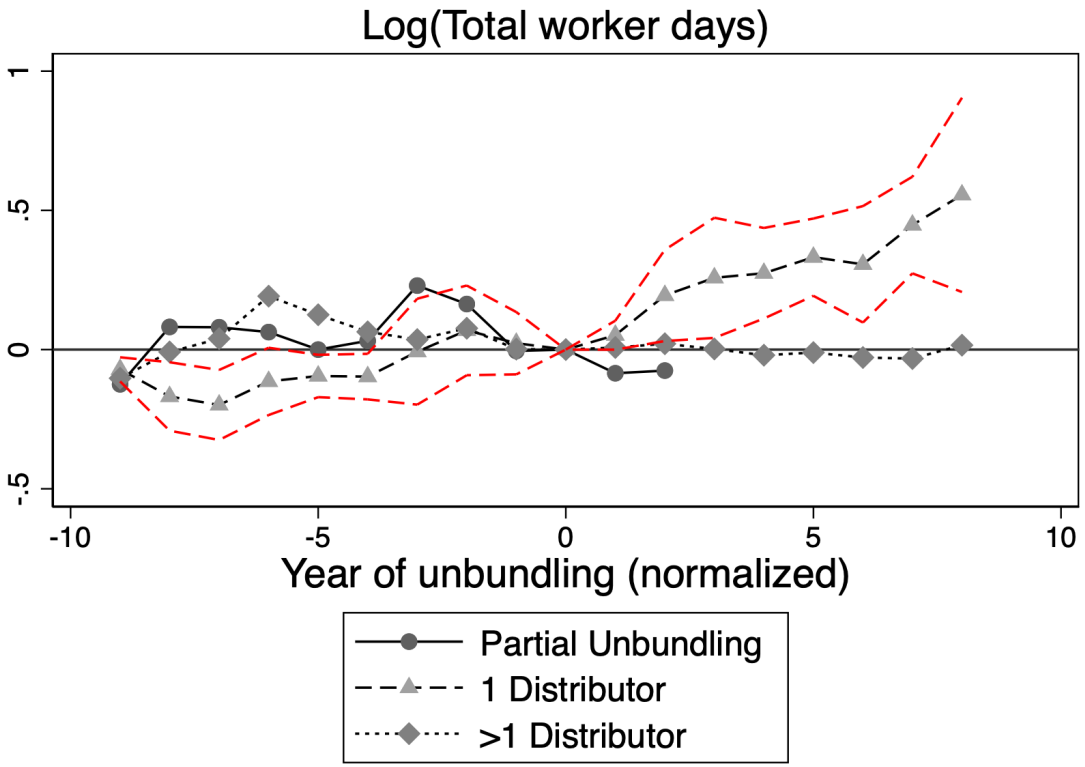
Effects on firm outcomes





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