Rural Infrastructure Development and Economic Activity

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Research Question

Do infrastructure improvement policies causally affect local economic activity?

Infrastructure

- Investments in physical infrastructure (roads, electricity, telecommunications, fast Internet, dams, irrigation, etc.) are important determinants of economic growth
- Most of the literature on the effects of infrastructure have focused either on local economic activity/households/large firms
  - Positive effects - Dams (Duflo and Pande, 2007), Rural electrification (Dinkelman (2011), electricity prices and shortages (Abeberese, 2016; Allcott et al., 2016), fast Internet (Hjort and Poulsen (2018), Rural roads and highways (Aggarwal (2018), Ghani et al. (2016))
  - No effects - Rural electrification (Burlig (2016), Lee et. al (2019), rural roads (Asher and Novosad (2019))

Place-based policies

- Infrastructure investments are inherently "place-based" policies (non-random placement)
- Governments throughout the world have used "place-based policies" to generate employment and productivity in lagging regions
  - financial incentives (tax exemptions, subsidies), land grants, infrastructure and other benefits to firms
- Place-based policies are popular across the world
- In rural settings – whether there will be demand for the infrastructure services is not clear
- In this paper $\rightarrow$ focus on the effects of a place-based infrastructure scheme on economic activity with a focus on firms

Background: Microenterprises

- A microenterprise in developing countries is mostly unregistered (informal), self-owned, employing only few workers
  - household-, family-owned entities
- Prevalent and important in all developing countries
  - accounts for 76% of employment in India's rural economy (Economic Census 2014)
  - Previous work on the effects of infrastructure and/or place-based policies have ignored this important sector

$\Rightarrow$ Crucial to policymakers' goals of economic growth and poverty eradication in backward regions

Findings

- Village employment increases
  - Village employment in microenterprises increase
  - No change in village employment in formal firms

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  - increase in employment
- No change for formal firms
- Extensive margin - number of microenterprises increases
- Wages and number of days worked for individuals increase, household consumption expenditure increases

Findings

- Mechanisms:
  - improvements in infrastructural environment (measured by night light intensity)
  - reduction in probability that firms experienced power shortage (electrification channel)
  - reduction in "no access to raw materials" (connectivity channel)

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- Heterogeneity
  - Effects stronger in electricity and road intensive industries
  - Effects larger in villages that had electricity and roads at the baseline
  - Distance to district headquarters matter

Rashtriya Sam Vikas Yojana (RSVY)

- Policy Intervention: RSVY
  - launched in the fiscal year of 2003-04
  - central government identified most "backward" districts based on a completely **transparent** selection procedure
    - regression discontinuity design
  - eligible districts received bundled infrastructure grants for improving rural connectivity, electrification, agricultural system, etc.

Rashtriya Sam Vikas Yojana (RSVY)

- 147 backward districts selected from 17 States
- Each district was entitled to receive grants amounts of 450 million Indian Rupees (approx. $7.2 million USD, 1.2% of the treated districts' GDP)
- Equally divided over the course of 3 fiscal years: 2004-05, 2005-06, and 2006-07

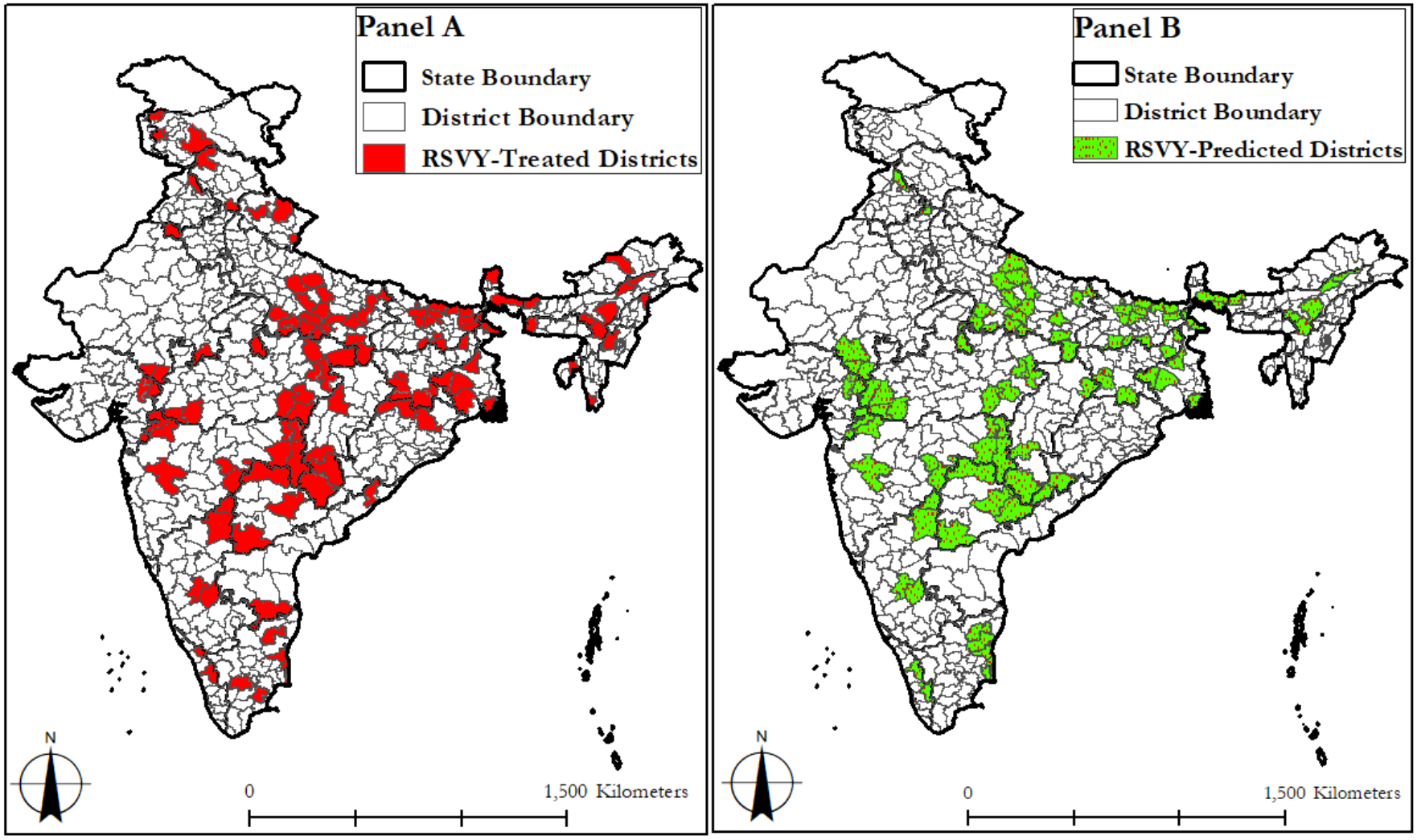
Empirical Design - Determinants of Eligibility

- Selection process is transparent, involving two steps:
- **First step:** central government determined the number of treated districts that would be assigned to each of India's states
  - proportional to % poverty headcount ratio
- **Second step:** each state government selected the districts eligible to receive RSVY grants
  - districts with lowest historical **backwardness rankings** (i.e. most backward) were selected
- **Regression Discontinuity Design** - reconstruction of selection rule allows us to compare marginal districts around the eligibility threshold

Reconstructing the Selection Process

- Reconstruct the Backwardness Score Index
  1. value of output per agricultural worker (1990-1993);
  2. agriculture wage rate (1996-1997);
  3. districts' percentage of low-caste (tribal) populations (1991)
- Rank districts' scores within State, determine:
  1. cutoff score for each State
  2. list of districts *should have been** eligible
  3. **RD running variable**: district's score distance to state-specific score threshold
- Fuzzy: existence of non-compliance with proposed assignment rule (endogenous selection)
- $\rightarrow$ Use reconstructed selection as **instrument** for actual selection (endogenous)
  - 81% prediction accuracy

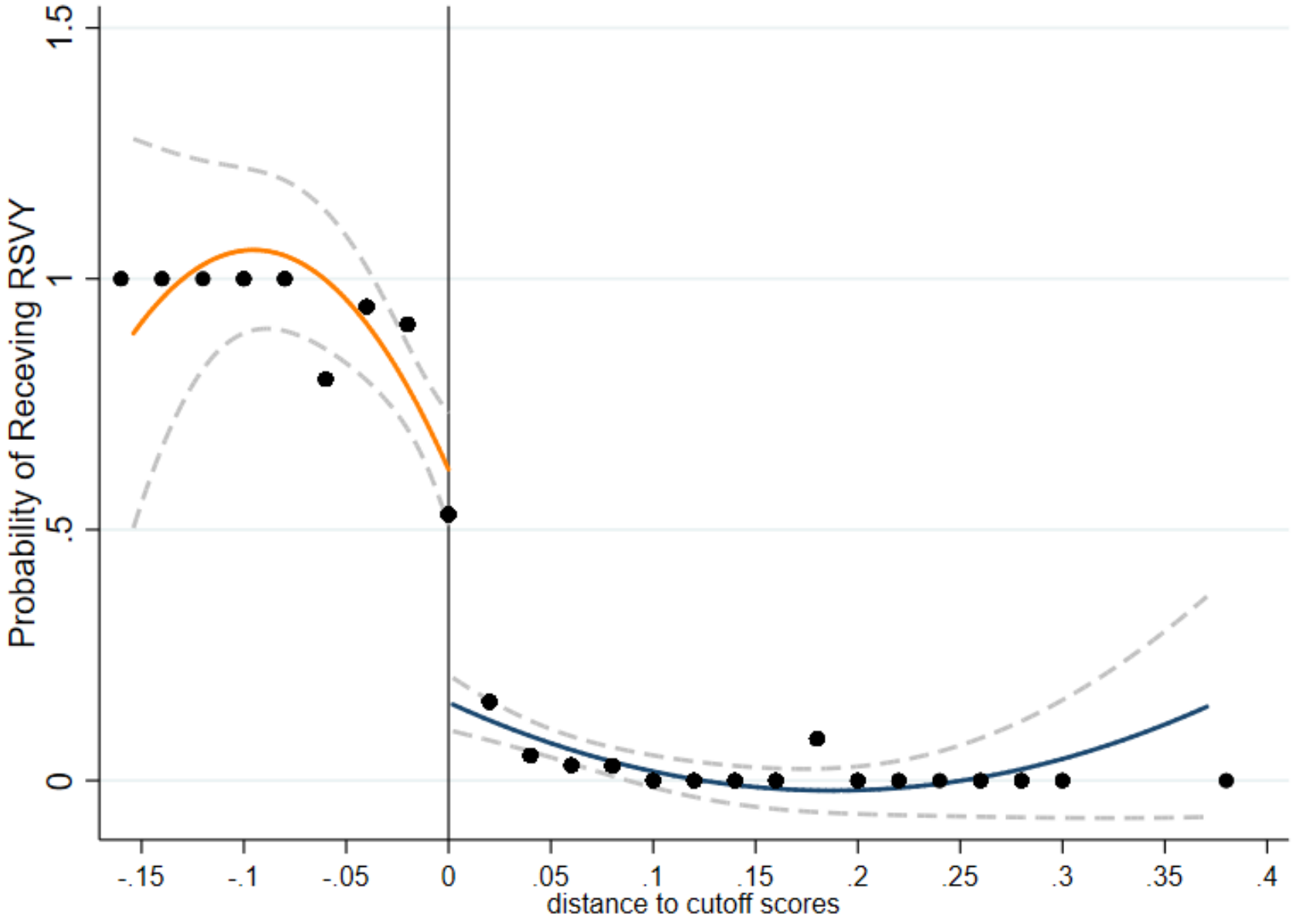
Actual Assignment - Map



Empirical Strategy

- **Empirical Strategy**: Regression Discontinuity Design
  - Running variable: districts' backwardness score distance from the State's cutoff (standardized at 0)
  - Instrument: predicted placement as per guideline (exogenous); replace endogenous actual assignment
- **RD identification assumption**: marginal districts around cutoff were selected "as good as random" (Lee and Lemieux, 2010)
  1. districts cannot manipulate eligibility
  2. adopt narrow bandwidth around threshold

First Stage - Discontinuity in Probability of Treatment



Empirical Specifications - Intent to Treat

$$y_{idst} = \alpha_0 + \alpha_1 RSVY_{ds} + \delta(z_{ds}, RSVY_{ds}) + X^1_{dt-1}\alpha_2 + X^2_d\alpha_3 + \pi_s + \varepsilon_{idst}$$

- y_{idst}: firm/village/household-level outcomes
- $RSVY_{ds}$: indicator for districts that **should** have received RSVY
- $\delta(z_{ds}, RSVY_{ds})$: polynomial function of running variable z_{ds} and treatment dummy $RSVY_{ds}$
- X^1_{dt-1}: district's baseline socio-demographic characteristics
  - Population; share of SC/ST; prevalence of public facilities
- X^2_d: time-invariant (geographic) controls
  - district area; boundary; elevation; distance to nearest city; avg distance to the nearest 5 cities
- π_s: state fixed effects

Empirical Specifications - Treatment on the treated

- Districts that actually got the grant may be endogenously picked by the state
- Instrument the districts that **actually** received the grant using the districts that **should** have received the grant using the distance score
- Identifying instrument: $\mathbf{1}\{z_{ds} \leq 0\}$

$$y_{idst} = \beta_0 + \beta_1 \mathbf{1}\{z_{ds} \leq 0\} + \delta(z_{ds}, \mathbf{1}\{z_d \leq 0\}) + X^1_{dt-1}\beta_2 + X^2_d\beta_3 + \pi_s + \varepsilon_{idst}$$

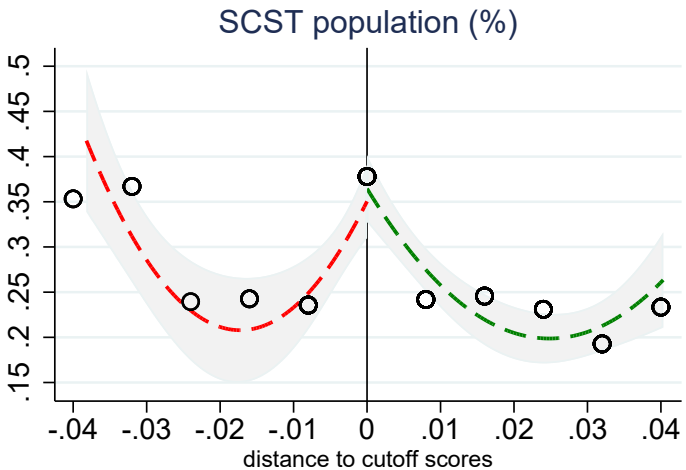
Data

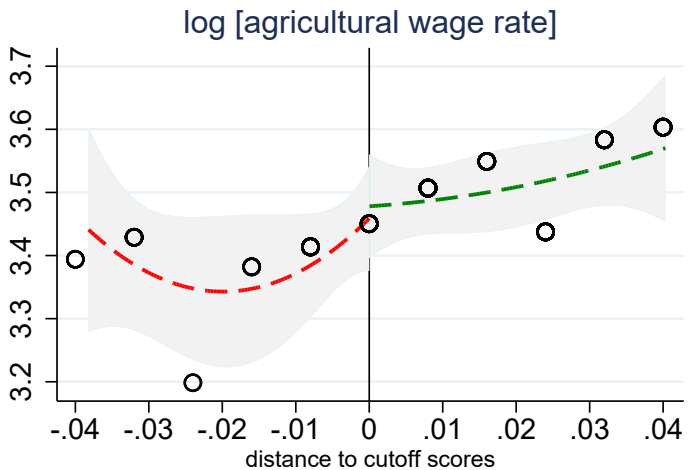
- Economic Census – covers all nonfarm activity in India
  - Fifth round (2005 post-policy period)
  - Fourth round (1998, pre-policy period)
- National Sample Survey - Unorganized Manufacturing Enterprise (Schedule 2.2) (NSS) – microenteprises
  - Round 62 (2005-06, post-policy period)
  - Round 56 (2000-01, pre-policy period)
- Annual Survey of Industries firm-level data (2001-06) – formal firms
- NSS Employment-Unemployment Surveys (Schedule 10) – individual and household outcomes
  - Round 62 (2005-06, post-policy period)
  - Round 55 (1999-00, pre-policy period)
- Population Census (2001 -baseline) for socio-demographic controls
- Nighttime Light Intensity collected from NASA's satellite images (processed by the NOAA)

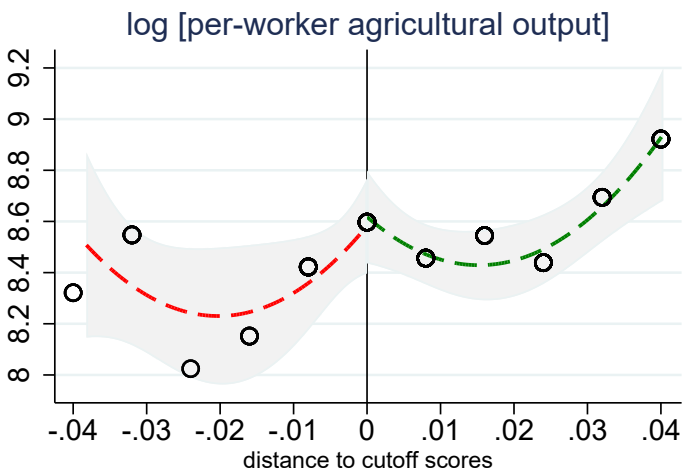
Summary Statistics - Firm Level

	Observations	Mean	SD	Source
Panel A: District's Employment and Firms (1998)				
1.Employment Outcomes (per firm):				
Total Employment	4,471,441	2.174	30.733	EC 1998
Formal Employment	32,416	47.292	357.620	EC 1998
Informal Employment	4,439,025	1.844	1.600	EC 1998
2. Firm Outcomes (per village):				
Total Firms	97,863	98,762.14	96,516.75	EC 1998
Formal Firms	97,863	526.00	595.36	EC 1998
Informal Firms	97,863	98,236.13	96,066.84	EC 1998
Panel B: Microenterprises (2000-01)				
1. Outcome Measures:				
Employment (labor count)	20,191	2.156	2.810	NSS56 -Sch. 2.2
Revenue ('000 Rs)	20,191	86.844	461.083	NSS56 -Sch. 2.2
2. Mechanism Measures:				
Problem of Experiencing Power Cut (%)	20,191	0.188	0.391	NSS56 -Sch. 2.2
Problem with Access to Materials (%)	20,191	0.185	0.388	NSS56 -Sch. 2.2

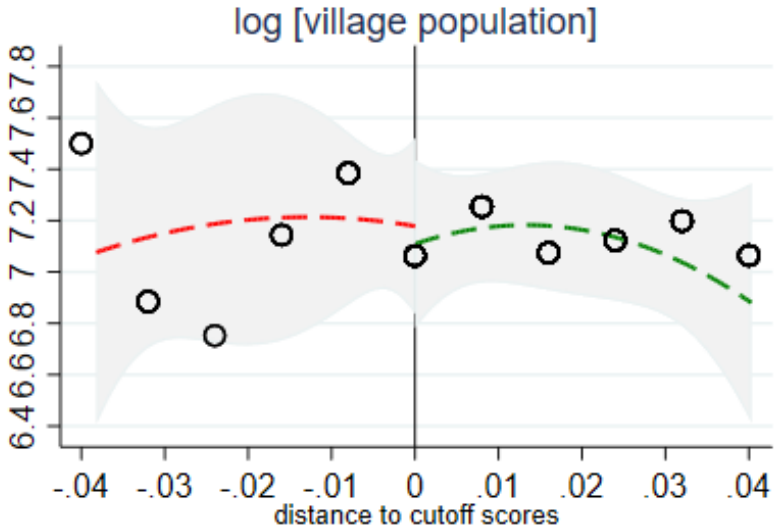
Validity of RDD - socio-demographic

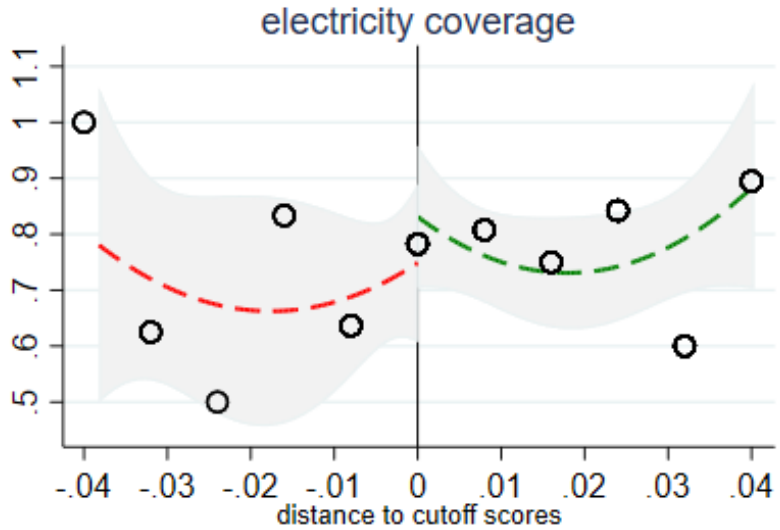


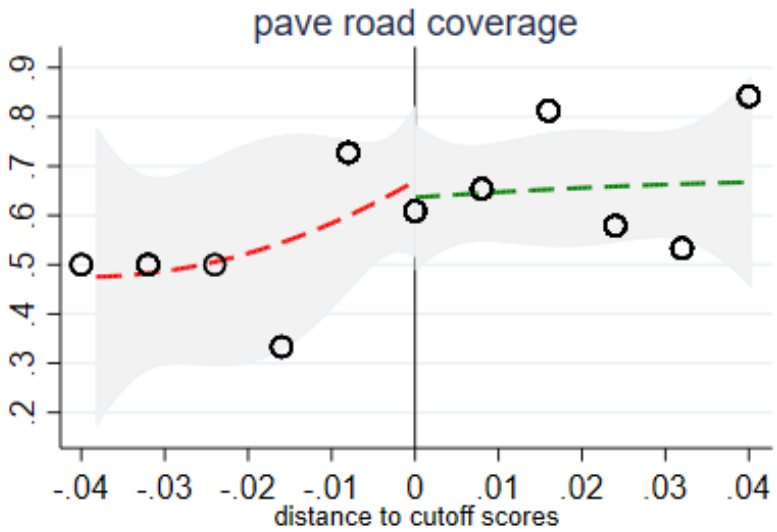




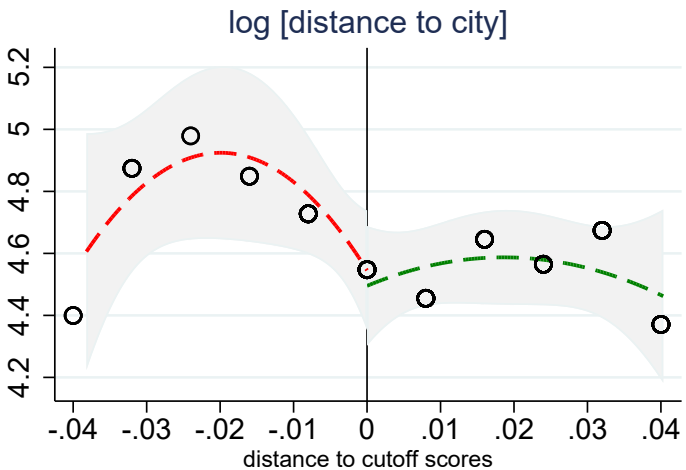
Validity of RDD - infrastructure

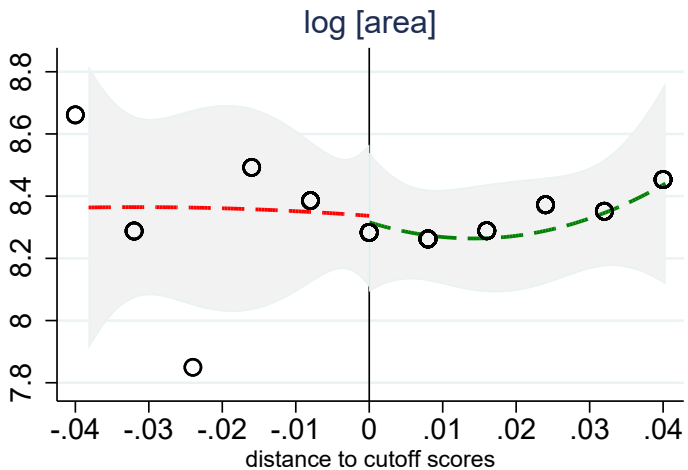


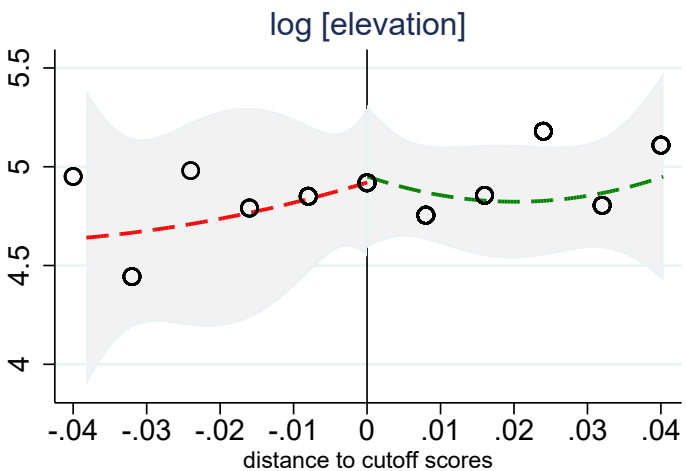


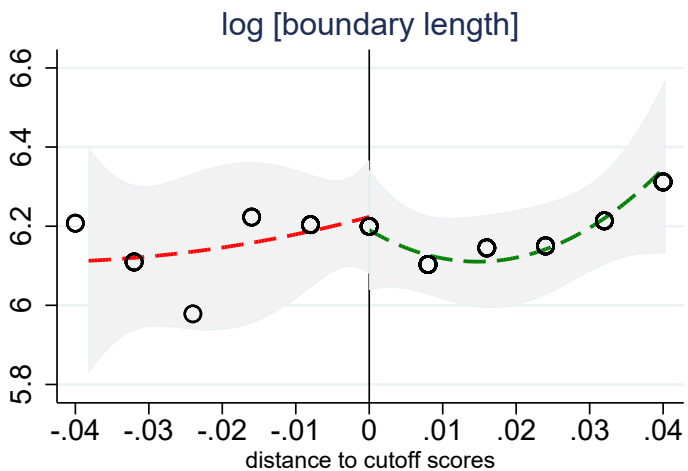


Validity of RDD - geographic



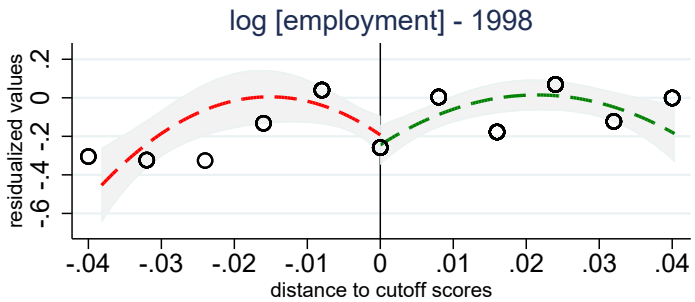


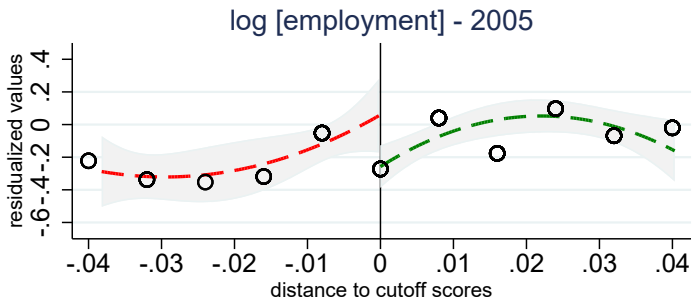


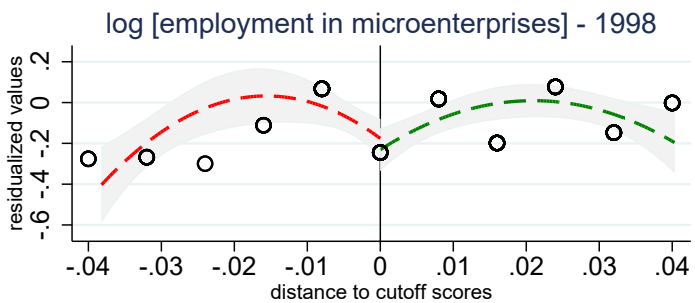


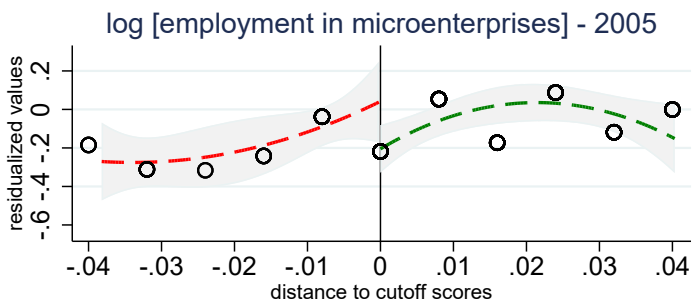
Empirical Results

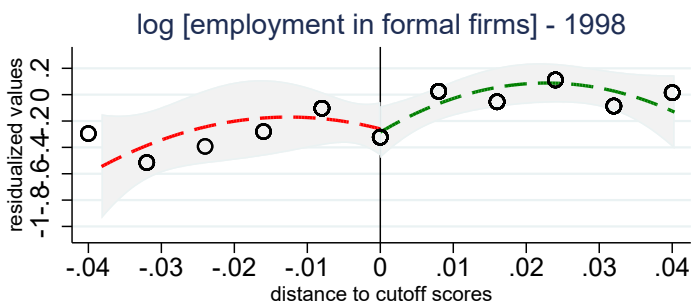
Village employment

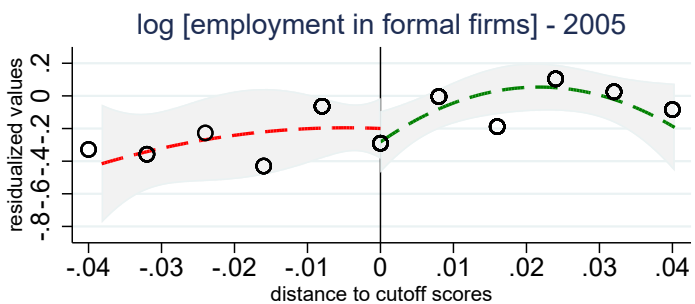










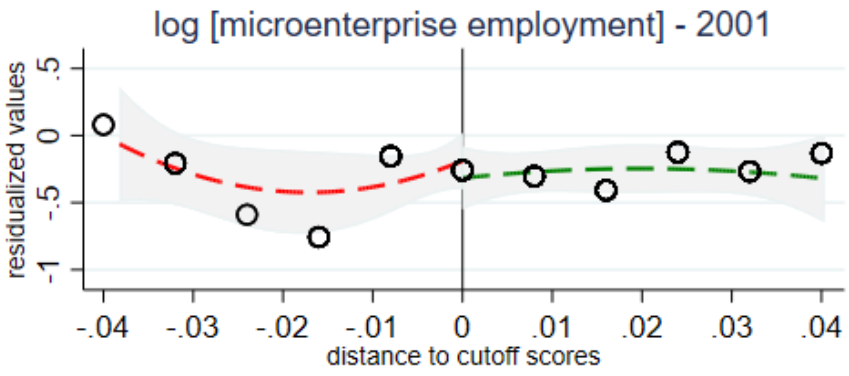


Village employment (Economic Census 2005) ↑

	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Village Employment						
1. Total Employment						
RD Estimate	0.120	0.111	0.122	0.139*	0.144*	0.175**
S.E.	(0.0851)	(0.0817)	(0.0805)	(0.0740)	(0.0770)	(0.0733)
R-square	0.580	0.580	0.572	0.572	0.579	0.580
Observations	73,335	73,335	83,356	83,356	92,677	92,677
2. Microenterprise Employment						
RD Estimate	0.123	0.115	0.129	0.145**	0.149*	0.183**
S.E.	(0.0827)	(0.0792)	(0.0786)	(0.0727)	(0.0756)	(0.0716)
R-square	0.590	0.590	0.582	0.582	0.589	0.590
Observations	73,302	73,302	83,313	83,313	92,633	92,633
3. Formal Employment						
RD Estimate	0.0550	0.0649	0.0170	0.0160	0.0332	0.0184
S.E.	(0.0698)	(0.0728)	(0.0683)	(0.0722)	(0.0573)	(0.0577)
R-square	0.102	0.102	0.099	0.099	0.115	0.115
Observations	7,100	7,100	7,627	7,627	8,942	8,942
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Microenterprises - Employment



Microenteprises - Employment (2005-06) ↑

	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Employment (log)						
RD Estimate	0.124**	0.132***	0.0975*	0.0939*	0.0921**	0.0856**
S.E.	(0.0500)	(0.0490)	(0.0511)	(0.0530)	(0.0410)	(0.0419)
R-square	0.345	0.346	0.342	0.342	0.349	0.350
Observations	6,758	6,758	7,579	7,579	8,580	8,580
Panel B: Employment (level)						
RD Estimate	0.675***	0.672***	0.558***	0.566***	0.479***	0.465***
S.E.	(0.212)	(0.201)	(0.200)	(0.209)	(0.165)	(0.169)
R-square	0.230	0.230	0.237	0.237	0.240	0.241
Observations	6,758	6,758	7,579	7,579	8,580	8,580
Bandwidth	0.02		0.025		0.03	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes

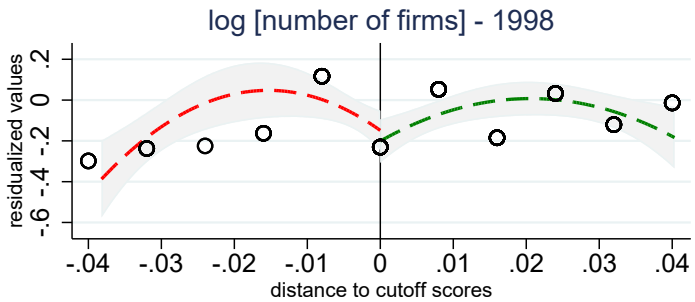
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

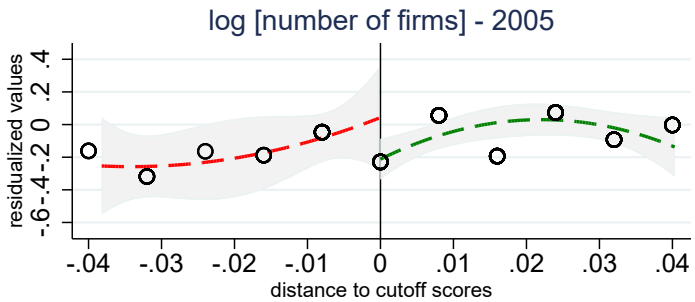
Formal firms – no effect

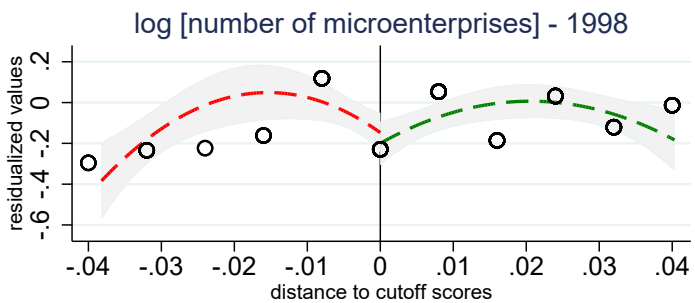
	Employment (log)		Revenue (log)		Employment (log)		Revenue (log)		Employment (log)		Revenue (log)	
	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Year: 2004	0.128	0.141	-0.0807	0.0435	0.0597	0.0642	-0.160	-0.118	-0.0125	-0.0252	0.0914	-0.0571
	(0.132)	(0.131)	(0.188)	(0.211)	(0.125)	(0.130)	(0.190)	(0.214)	(0.107)	(0.111)	(0.167)	(0.173)
	2,206	2,206	1,936	1,936	2,334	2,334	2,051	2,051	2,742	2,742	2,396	2,396
Year: 2005	0.254	0.267	0.338	0.460	0.190	0.195	0.175	0.208	-0.0560	-0.0164	0.162	0.0623
	(0.174)	(0.168)	(0.291)	(0.298)	(0.156)	(0.154)	(0.289)	(0.291)	(0.136)	(0.143)	(0.238)	(0.252)
	2,043	2,043	1,749	1,749	2,164	2,164	1,848	1,848	2,602	2,602	2,197	2,197
Bandwidth /z/	0.02				0.025				0.03			
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

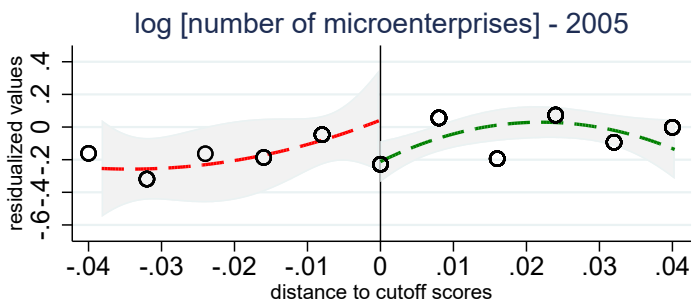
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

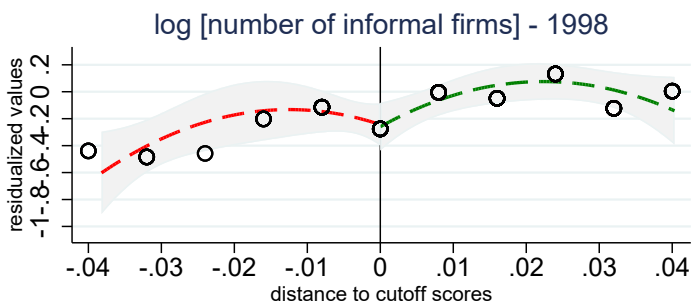
Extensive Margin – Number of firms (2005)

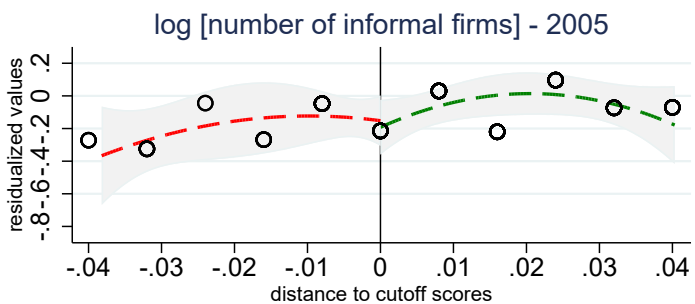












Extensive Margin – Number of firms (2005) ↑

	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Village level – Number of firms (log)						
1. All Firms						
RD Estimate	0.0985	0.0890	0.130*	0.141*	0.151**	0.180**
S.E.	(0.0855)	(0.0807)	(0.0737)	(0.0715)	(0.0744)	(0.0710)
R-square	0.599	0.600	0.593	0.594	0.600	0.600
Observations	73,335	73,335	83,356	83,356	92,677	92,677
2. Microenterprises						
RD Estimate	0.0980	0.0885	0.130*	0.142*	0.151**	0.181**
S.E.	(0.0854)	(0.0807)	(0.0737)	(0.0716)	(0.0744)	(0.0710)
R-square	0.599	0.599	0.593	0.593	0.599	0.600
Observations	73,302	73,302	83,313	83,313	92,633	92,633
3. Formal Firms						
RD Estimate	0.0465	0.0445	0.0279	0.0275	0.0188	0.00864
S.E.	(0.0384)	(0.0402)	(0.0391)	(0.0407)	(0.0314)	(0.0335)
R-square	0.134	0.134	0.131	0.131	0.141	0.141
Observations	7,100	7,100	7,627	7,627	8,942	8,942

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Microenterprises – Established < 3 years ago (%) (2005) ↑

	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Microenterprises – Established less than 3 years ago(%)						
RD Estimate	0.0784**	0.0519	0.107***	0.108***	0.0998***	0.104***
S.E.	(0.0327)	(0.0318)	(0.0313)	(0.0309)	(0.0320)	(0.0323)
R-square	0.183	0.187	0.173	0.173	0.158	0.159
Observations	6,528	6,528	7,349	7,349	8,350	8,350
Bandwidth ($\|z\|$)	0.02		0.025		0.03	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes	Yes	Yes
Village Controls	Yes	Yes	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Individual and household outcomes (2005-06) ↑

	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Wage (log)						
RD Estimate	0.123*	0.123*	0.114*	0.101*	0.135**	0.128**
S.E.	(0.0728)	(0.0728)	(0.0619)	(0.0585)	(0.0538)	(0.0544)
R-square	0.360	0.360	0.360	0.361	0.358	0.358
Observations	4,914	4,914	5,422	5,422	6,232	6,232
Panel B: Days worked (in the last 7 days) (log)						
RD Estimate	0.0331**	0.0333**	0.0326*	0.0299*	0.0318**	0.0320**
S.E.	(0.0159)	(0.0157)	(0.0177)	(0.0175)	(0.0145)	(0.0144)
R-square	0.051	0.051	0.050	0.050	0.049	0.049
Observations	31,290	31,290	34,818	34,818	39,143	39,143
Panel C: Monthly household consumption expenditure (log)						
RD Estimate	0.0883*	0.0867*	0.122**	0.114**	0.122***	0.122***
S.E.	(0.0489)	(0.0512)	(0.0477)	(0.0466)	(0.0423)	(0.0419)
R-square	0.191	0.191	0.182	0.184	0.162	0.162
Observations	6,602	6,602	7,357	7,357	8,249	8,249
Bandwidth	0.02		0.025		0.03	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Treatment on Treated Estimates (IV)

Dependent Variable	Linear			Quadratic			
	RD Estimate	S.E.	R-Square	RD Estimate	S.E.	R-Square	Observations
Panel A: RSVY Impact on Employment – Economic Census 2005							
A1: Village Employment (log)							
Total Employment	0.591*	(0.345)	0.560	0.748*	(0.423)	0.553	92,677
Formal Employment	0.149	(0.144)	0.112	0.116	(0.137)	0.113	8,942
Informal Employment	0.602*	(0.348)	0.568	0.772*	(0.429)	0.560	92,633
A2: Firm-level Employment (log)							
All Firms	0.120**	(0.0606)	0.015	0.120**	(0.0607)	0.015	4,921,316
Formal Firms	-0.147	(0.138)	0.070	-0.147	(0.140)	0.070	21,109
Informal Firms	0.113*	(0.0581)	0.016	0.113*	(0.0581)	0.016	4,900,207
Panel B: RSVY Impact on Microenterprises – NSS (Schedule 2.2) 2005-06							
Employment (log)	0.327**	(0.154)	0.242	0.332**	(0.158)	0.242	7,579
Employment (count)	1.694**	(0.697)	0.132	1.765**	(0.718)	0.129	7,579
Panel C: RSVY Impact on Household Welfare – NSS (Schedule 10) 2005-06							
Wages (log)	0.306	(0.197)	0.346	0.261	(0.171)	0.352	5,422
Days worked (last 7 days) (log)	0.103	(0.0692)	0.029	0.0996	(0.0684)	0.030	34,818
MHCE (log)	0.390*	(0.220)	0.148	0.360*	(0.205)	0.156	7,357
Panel D: Extensive Margin – RSVY Impacts on Firm Establishment							
D1: Village level – Firm Quantity (log)							
All Firms	0.599*	(0.342)	0.579	0.753*	(0.419)	0.571	92,677
Formal Firms	0.0554	(0.0724)	0.140	0.0338	(0.0731)	0.141	8,942
Informal Firms	0.599*	(0.343)	0.578	0.754*	(0.421)	0.570	92,633
D2: Microenterprises – Established less than 3 years (%)							
	0.279**	(0.126)	0.152	0.292**	(0.137)	0.150	7,579
Panel E: Microenterprises – Evidence on Impact Channels							
Power Cut (%)	-0.213**	(0.107)	0.123	-0.254	(0.181)	0.124	7,579
No Access to Materials (%)	-0.645**	(0.313)	0.052	-0.659**	(0.328)	0.047	7,579

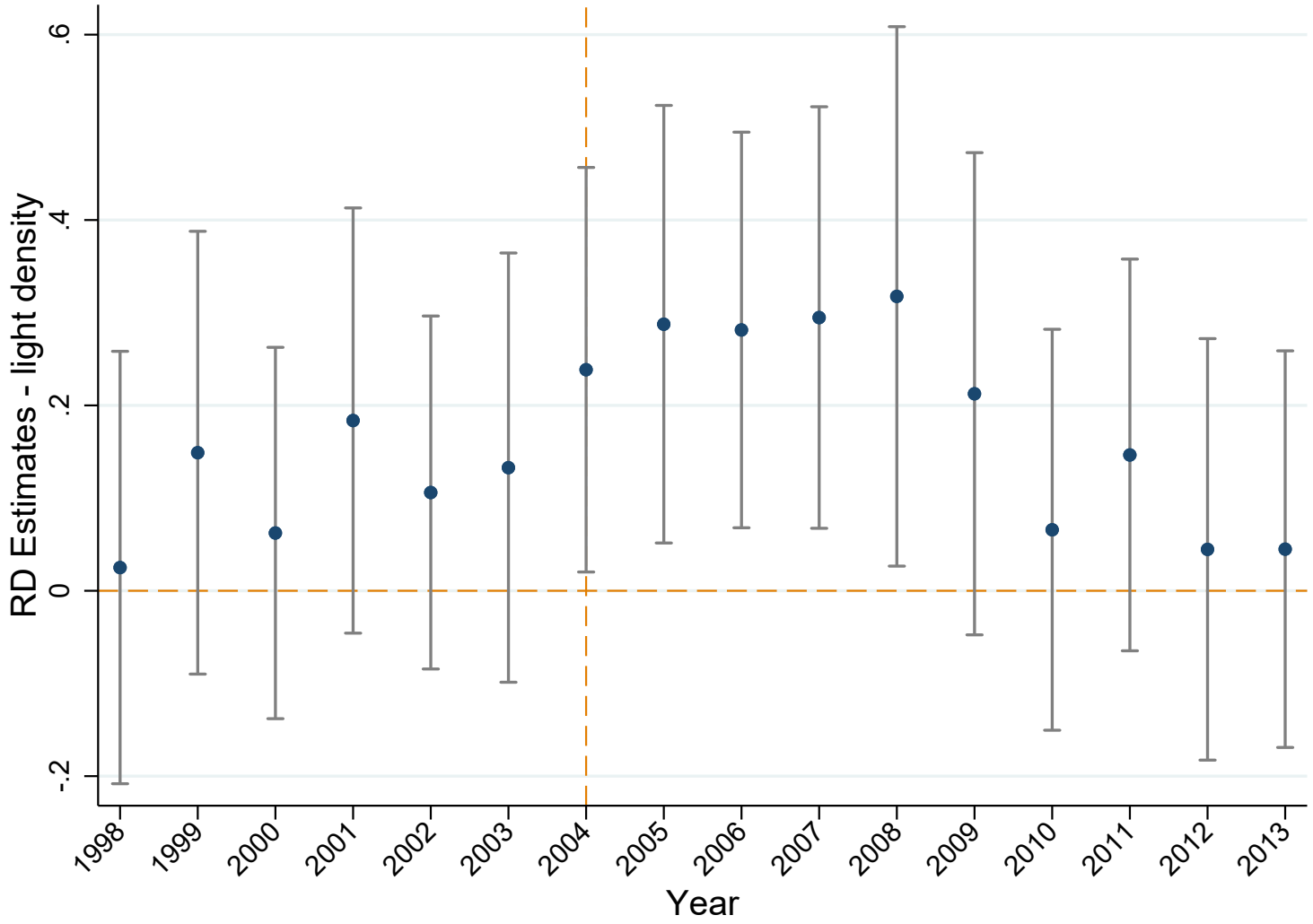
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Mechanisms

Mechanisms: Improved infrastructural condition relaxes production constraints for firms and eases supply chain problems

- Improved overall infrastructure - proxied by nightlight
- Lower probability of experiencing power cut (electrification)
- reduction in "no access to raw materials" (connectivity)
- Effects stronger in electricity and road intensive industries
- Effects stronger in villages that had electricity and roads at the baseline

District-wise improvement in infrastructure (night-light intensity)



Mechanism: electrification and connectivity ↑

	Linear	Quadratic	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Firm experiencing power cut (%)						
RD Estimate	-0.139**	-0.126**	-0.0723	-0.0834	-0.0881*	-0.0860*
S.E.	(0.0562)	(0.0555)	(0.0556)	(0.0565)	(0.0459)	(0.0468)
R-square	0.211	0.214	0.195	0.199	0.185	0.185
Observations	6,758	6,758	7,579	7,579	8,580	8,580
Panel B: Firm has no access to raw materials (%)						
RD Estimate	-0.178**	-0.183**	-0.171**	-0.171**	-0.110	-0.103
S.E.	(0.0796)	(0.0804)	(0.0791)	(0.0780)	(0.0823)	(0.0790)
R-square	0.253	0.253	0.233	0.233	0.210	0.211
Observations	6,758	6,758	7,579	7,579	8,580	8,580
Bandwidth	0.02		0.025		0.03	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Electricity-intensive industries

	(1)	(2)	(3)
Panel A: Electricity-intensive industries			
1. Employment (log)			
RD Estimate	0.220***	0.0975*	0.0661
S.E.	(0.0836)	(0.0511)	(0.0828)
R-squared	0.423	0.342	0.432
Observations	2,389	7,575	1,858
Degree of electricity intensity (tercile)	>66th	33rd to 66th	<33rd
2. Revenue (log)			
RD Estimate	0.804***	0.546***	0.156
S.E.	(0.219)	(0.145)	(0.241)
R-square	0.522	0.541	0.677
Observations	2,389	7,575	1,858
Degree of electricity intensity (tercile)	>66th	33rd to 66th	<33rd

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Road-intensive industries

	(1)	(2)	(3)
Panel B: Road-intensive industries			
1. Employment (log)			
RD Estimate	0.125	0.0839	0.0410
S.E.	(0.0851)	(0.0619)	(0.0443)
R-squared	0.376	0.323	0.332
Observations	2,599	2,828	2,152
Degree of road dependency (tercile)	>66th	33rd to 66th	<33th
2. Revenue (log)			
RD Estimate	1.045***	0.478**	0.213
S.E.	(0.330)	(0.214)	(0.174)
R-square	0.606	0.597	0.363
Observations	2,599	2,828	2,152
Degree of road dependency (tercile)	>66th	33rd to 66th	<33th

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Heterogeneity by pre-RSVY village characteristics

	Linear	Quadratic	Linear	Quadratic
	(1)	(2)	(3)	(4)
Panel A: Village employment in microenterprises (log)				
RD estimate	-0.0227	-0.0183	0.190**	0.199**
S.E.	(0.155)	(0.154)	(0.0895)	(0.0821)
R-squared	0.368	0.368	0.576	0.577
Observations	13,477	13,477	45,956	45,956
Sample	No roads or electricity	No roads or electricity	Roads and electricity	Roads and electricity
Panel B: Number of microenterprises in the village (log)				
RD estimate	-0.0170	-0.0163	0.179**	0.186**
S.E.	(0.150)	(0.150)	(0.0844)	(0.0800)
R-squared	0.383	0.383	0.586	0.587
Observations	13,477	13,477	45,956	45,956
Sample	No roads or electricity	No roads or electricity	Roads and electricity	Roads and electricity
State Fixed Effects	Yes	Yes	Yes	Yes
District Controls	Yes	Yes	Yes	Yes
Village Controls	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Proximity to district headquarters

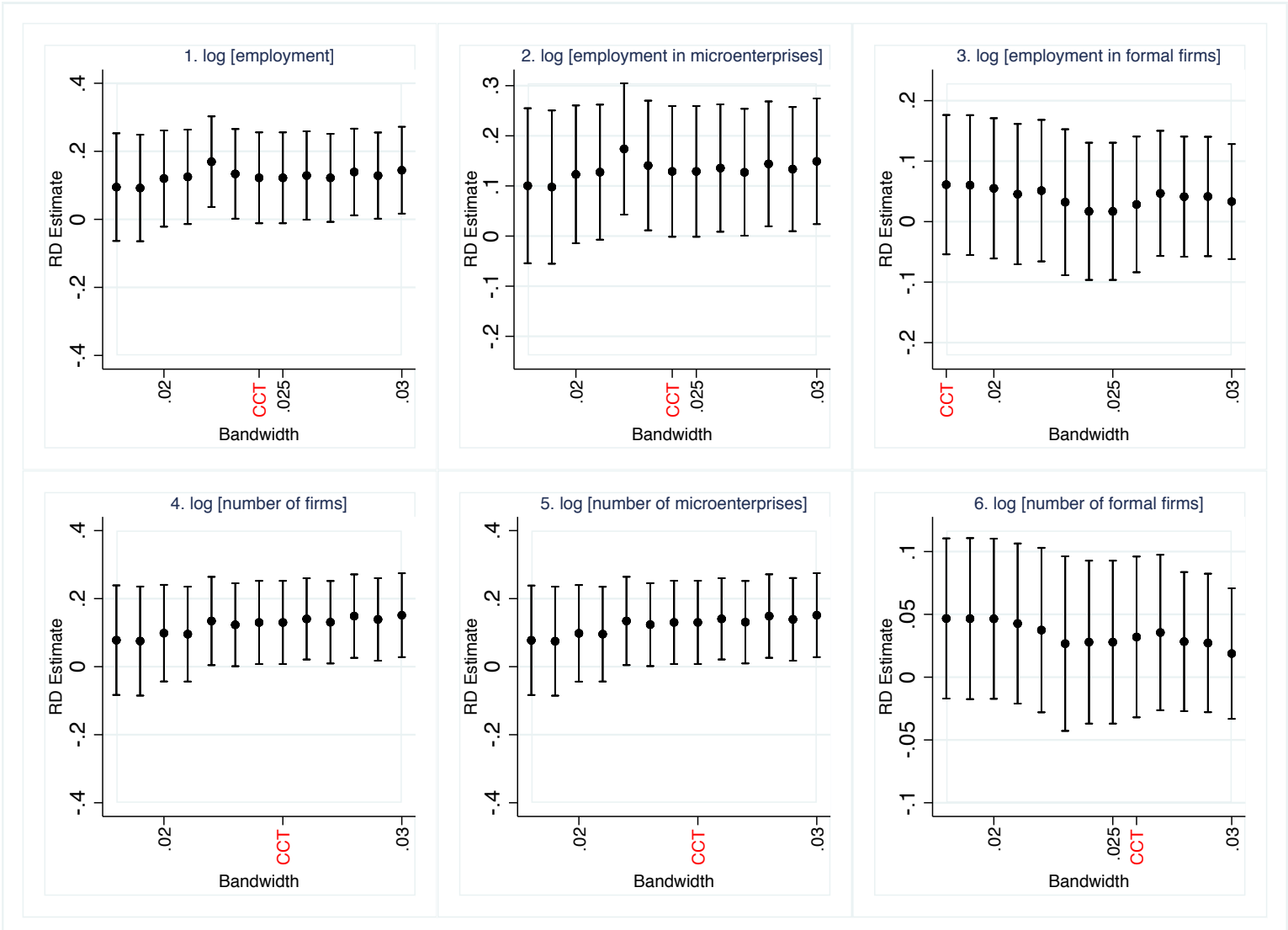
	Microenterprise Employment			Number of Microenterprises		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Standardized distance interaction						
RSVY X standardized distance	-0.0348	-0.0413*	-0.0487*	-0.0343	-0.0442*	-0.0494**
	(0.0221)	(0.0235)	(0.0252)	(0.0219)	(0.0225)	(0.0242)
R-squared	0.603	0.594	0.601	0.617	0.609	0.614
Observations	88,598	79,278	69,267	88,598	79,278	69,267
Panel B: Log distance interaction						
RSVY X log(distance)	-0.0477	-0.0606*	-0.0753*	-0.0457	-0.0651*	-0.0761**
	(0.0339)	(0.0363)	(0.0385)	(0.0326)	(0.0334)	(0.0355)
R-squared	0.603	0.594	0.601	0.617	0.609	0.614
Observations	88,600	79,280	69,269	88,600	79,280	69,269
Bandwidth	0.03	0.025	0.02	0.03	0.025	0.02
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Village Controls	Yes	Yes	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

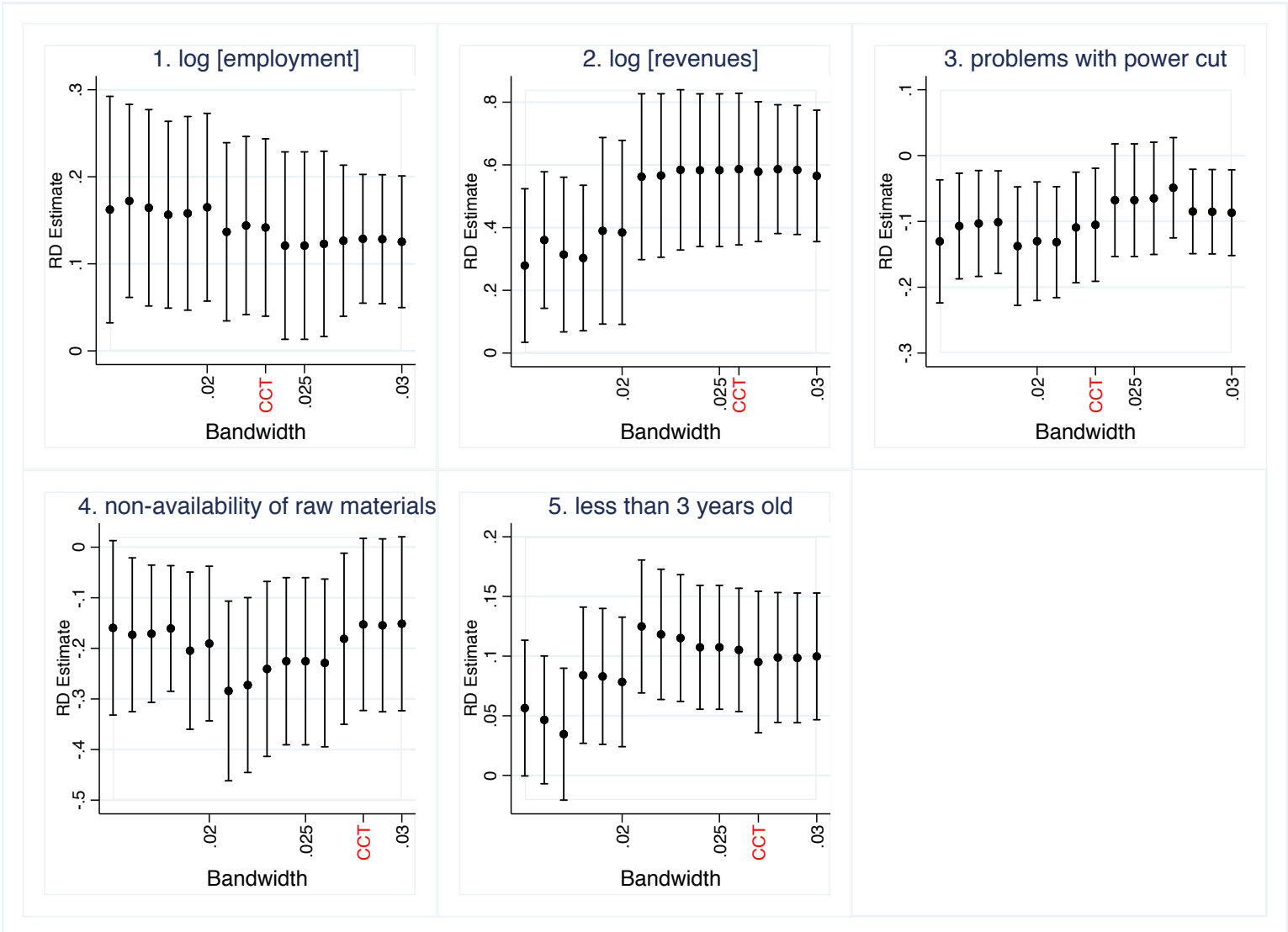
Robustness

- Results robust to different bandwidths (including data-driven bandwidths)
- No effect using baseline data (pre-RSVY)
- No effect at hypothetical cutoffs

Sensitivity analysis (village outcomes)



Sensitivity analysis (microenterprise outcomes)



Pre-RSVY – No Effect using Baseline Data

	Linear			Quadratic			
	RD Estimate	S.E.	R-Square	RD Estimate	S.E.	R-Square	Observations
Panel A: RSVY Impact on Employment – Economic Census 1998							
A1: Village Employment (log)							
Total Employment	0.101	(0.0978)	0.488	0.112	(0.0965)	0.488	83,695
Informal Employment	0.111	(0.0947)	0.502	0.124	(0.0926)	0.502	83,591
Formal Employment	-0.0897	(0.0960)	0.059	-0.0910	(0.0937)	0.059	7,546
A2: Firm-level Employment (log)							
All Firms	-0.0367	(0.0418)	0.020	-0.0351	(0.0393)	0.024	3,449,092
Formal Firms	-0.0396	(0.0812)	0.065	-0.0342	(0.0739)	0.068	22,333
Informal Firms	-0.0341	(0.0393)	0.022	-0.0326	(0.0374)	0.026	3,426,759
Panel B: RSVY Impact on Microenterprises – NSS (Schedule 2.2) 2000-01							
Employment (log)	0.0809	(0.0542)	0.216	0.0730	(0.0524)	0.216	17,842
Employment (count)	0.192	(0.153)	0.121	0.205	(0.152)	0.121	17,842
Revenue (log)	0.0304	(0.162)	0.344	0.0622	(0.158)	0.345	17,842
Revenue (level)	-10,881	(8,974)	0.083	-10,251	(8,719)	0.083	17,842
Panel C: RSVY Impact on Household Welfare – NSS (Schedule 10) 1999-00							
Wages (log)	0.0810	(0.0673)	0.332	0.0817	(0.0683)	0.332	16,253
Days worked (last 7 days) (log)	0.0466	(0.0407)	0.062	0.0488	(0.0400)	0.062	35,265
MHCE (log)	-0.0404	(0.0581)	0.218	-0.0419	(0.0580)	0.220	6,450
Panel D: Extensive Margin – RSVY Impacts on Firm Establishment							
Village level – Firm Quantity (log)							
All Firms	0.0990	(0.0870)	0.499	0.116	(0.0824)	0.500	83,695
Formal Firms	-0.0224	(0.0604)	0.099	-0.0240	(0.0565)	0.100	7,546
Informal Firms	0.101	(0.0872)	0.498	0.118	(0.0825)	0.499	83,591
Panel E: Microenterprises – Evidence on Impact Channels							
Power Cut (%)	-0.0426	(0.0561)	0.107	-0.0456	(0.0543)	0.107	17,842
No Access to Raw Materials (%)	-0.0393	(0.0596)	0.139	-0.0380	(0.0596)	0.139	17,842

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

No Effect at Hypothetical Cutoff

	Linear			Quadratic			
	RD Estimate	S.E.	R-Square	RD Estimate	S.E.	R-Square	Observations
Panel A: RSVY Impact on Employment – Economic Census 2005							
A1: Village Employment (log)							
Total Employment	-0.184	(0.128)	0.559	-0.188	(0.126)	0.559	84,665
Informal Employment	-0.199	(0.128)	0.564	-0.202	(0.127)	0.564	84,647
A2: Firm-level Employment (log)							
All Firms	-0.0979	(0.0679)	0.023	-0.111*	(0.0661)	0.023	2,716,904
Informal Firms	-0.0980	(0.0627)	0.025	-0.110*	(0.0615)	0.025	2,704,032
Panel B: RSVY Impact on Microenterprises – NSS (Schedule 2.2) 2005-06							
Employment (log)	-0.111	(0.108)	0.393	-0.0399	(0.107)	0.395	2,854
Employment (count)	-0.320	(0.357)	0.345	-0.178	(0.370)	0.346	2,854
Revenue	-0.803***	(0.254)	0.542	-0.843***	(0.282)	0.542	2,854
Panel C: RSVY Impact on Household Welfare – NSS (Schedule...) 2005-06							
Wage	-0.108	(0.104)	0.382	-0.174	(0.136)	0.383	1,880
Days worked (last 7 days) (log)	-0.0801	(0.0563)	0.057	-0.0821**	(0.0330)	0.062	8,053
MHCE (log)	0.203	(0.153)	0.307	0.170	(0.154)	0.307	2,172
Panel D: Extensive Margin – RSVY Impacts on Firm Establishment							
Village level – Firm Quantity (log)							
All Firms	-0.152	(0.114)	0.587	-0.154	(0.113)	0.587	84,665
Informal Firms	-0.152	(0.114)	0.587	-0.155	(0.113)	0.587	84,647
Panel E: Microenterprises – Evidence on Impact Channels							
Power Cut (%)	-0.00224	(0.133)	0.323	0.0880	(0.123)	0.326	2,854
No Access to Materials (%)	0.462	(0.330)	0.361	0.350	(0.362)	0.362	2,213

Conclusion

- We find direct economic impacts of RSVY, an infrastructure development policy, on microenterprises' performance in India's backward regions
- We find improvement in infrastructure conditions (both rural electrification and connectivity) following policy introduction, which in turn likely relaxed firm's production constraints
- Results indicate that microenterprises - those among the intended targets of many anti-poverty programs - could benefit, as long as the policies are implemented effectively

Thank you

Thank you!