Comments on Kotani (2024) "Connecting to Electricity: Technical Change and Regional Development"

Jun Goto

GRIPS

November 9, 2024

Summary

Big Picture

- Technological change → regional development?

Research Question:

Does early electricity access increase the number of establishments and manufacturing employment in early 20th-century Japan?

- The technical change:
  - from steam engines to electric motors
- Instrument: hydropower potential
- Results: electric motors → lower fixed costs → new entrants → more establishments
- Long-term effects on regional development

General Comments

Highly Relevant and Rigorous Work!

- Important research question with appropriate research design
- Very well-written and well-organized
- Although the related literature is quite accumulated (esp, Reichardt 2024), this adds new evidence regarding mechanisms behind the main story
  - Electricity connection induces new entrant-driven regional development

Reinforcing Your Story: Distributional Effects of Technology Adoption

Heterogeneity That Can Support Your Hypothesis:

- Pro-distributional Potential of Electric Motors:
  - If electric motors truly reduce entry barriers, they should increase smaller establishments.
- Unequal Adoption Across Regions:
  - Are municipalities heavily invested in steam engines slower to adopt electric motors due to sunk costs and dependency on existing infrastructure?
- Regional Inequality:
  - Could regions with slow electric motor adoption experience heightened inequality, as larger firms (still using steam engines) dominate these local economies?

Unclear Definition:
Who are "New Entrants" and "Incumbents"?

Paper's Key Contribution:

- The role of new entrants in regional development

Paper's Definition of New Entrants:

- an establishment that began operating between 1909 and 1919
- If it's true, the outcome $\approx$ # of New Entrants
- Then, by def., you have no outcome variation for incumbents.

Question:

- Why could you estimate a coefficient for incumbents?

Really New-entrants-driven? Interpretation of Table 5

- The total effect is larger in new entrants than incumbents.
- Electric motors doesn't much explain it.
- It implies that establishments with something other than electric motors has prominently increased in new entrants.

Table 5: Mechanism: Effect of Electricity Access on Entrant Activities (1909-1919)

	Δ Number of Establishments						Demographics	
	Total		w/ Steam Engine		w/ Electric Motor		Δ Mnf. Workers	
	(1) All	(2) Entrant	(3) All	(4) Entrant	(5) All	(6) Entrant	(7) All	(8) Entrant
Electricity Access in 1914	2.00**	2.69***	0.277	0.273	1.29***	0.909***	121.7***	105.3***
	(1.02)	(0.858)	(0.215)	(0.170)	(0.404)	(0.265)	(43.3)	(37.5)
Model	IV	IV	IV	IV	IV	IV	IV	IV
Prefecture FE	✓	✓	✓	✓	✓	✓	✓	✓
Geography	✓	✓	✓	✓	✓	✓	✓	✓
Pop. density 1908	✓	✓	✓	✓	✓	✓	✓	✓
Streamflow	✓	✓	✓	✓	✓	✓	✓	✓
Ruggedness	✓	✓	✓	✓	✓	✓	✓	✓
Observations	10,005	10,005	10,005	10,005	10,005	10,005	10,005	10,005
First stage F-stat	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9
Mean of dep.var	0.30	0.58	0.05	0.14	0.36	0.23	24.7	28.3

Sources of New Entrants and Employees in Technological Transition

Potential Insights for Structural Transformation

- Structural Shift from Agriculture to Manufacturing?:
  - Technological advancements lower production costs, drawing labor from agriculture to manufacturing.
- Labor Mobility and Skill Upgrading:
  - As the economy shifts, rural populations may relocate to urban centers.
- Sectoral Income Redistribution:
  - Transitioning labor to higher-paying manufacturing jobs could reduce rural income disparity but might widen it within urban settings as skill gaps emerge.

Concerns on the Key Treatment Variable

Main Specification using: # of establishment:

$$\Delta Y_{i,p} = \eta \text{Electricity Access}_{i,1914} + \theta \ln(\text{PopDens}_{i,1908}) + \tau_p + \varepsilon_{i,p}$$

$\rightarrow$ Why only an $ElectricityAccess_{1914}$ dummy?

Estimation Bias?

- Omitted variable bias: all later impacts are dropped
- Implicit assumption:
  1. later adopters after 1914 have no impacts
  2. all adopters by 1914 have same impacts

$\rightarrow$ overestimates for relatively later adopters by 1914

Suggestion:

- Continuous early electricity access years

Concerns on the Main Specification

Main Specification using: # of establishment:

$$\Delta Y_{i,p} = \eta \text{Electricity Access}_{i,1914} + \theta \ln(\text{PopDens}_{i,1908}) + \tau_p + \varepsilon_{i,p}$$

- Why not include steam engine usages?
  - obviously correlated with electricity access and an instrument

  $\rightarrow$ violate exclusion restriction

The Construction of the Instrument

Instrument Definition:

$$HydropowerPotential_j = WaterVolumeIndex_j \times HydraulicHeadHeight_j$$

Concerns for Exclusion Restriction:

- Why not include each component in the first stage?
- Such exclusion may lead violation of exclusion restriction

Persistent Effects Using the Same IV

- The instrument without time variation may not fully account for dynamic effects (see Pedro Picchetti's JMP 2024)