Move on up – Electrification and Internal Migration

Angelika J. Budjan, Heidelberg University & University of Göttingen

Introduction

- **Rural infrastructure investments** are an important tool to foster development without relying on urban centers as sole engines of growth
- Often the underlying motivation of rural infrastructure investment is not only to foster productivity, but also to **reduce rural out-migration** which has been associated with negative effects on both the sending (Baum-Snow et al. 2020) and the receiving communities (Henderson 2020)

Research Question

How does investment in rural electricity infrastructure affect migration pattern in a developing country context?

- How does it interact with migration pull factors?
- What can we learn about policy options to address the rural-urban gap?

Theoretical considerations

There are two opposing mechanism how new electricity infrastructure can affect internal migration

- **Rise in incomes**

$$productivity \uparrow \rightarrow incomes \uparrow \rightarrow out-migration \downarrow$$

- **Easing credit constraints**

$$\boldsymbol{productivity \uparrow \rightarrow incomes \uparrow \rightarrow credit\ constraints \downarrow \rightarrow out-migration \downarrow}$$

Empirical Analysis

First difference model with state-wave fixed effects and location specific time-constant controls

$$\boldsymbol{\Delta Y_{ijt} = \alpha \Delta D_{ijt} + \beta' X_{ij} + \gamma_{jt} + \varepsilon_{ijt}}$$

- Y_{ijt} vector of outcomes
- D_{ijt} binary indicator for being within 15 km of new grid line
- X_{ij} vector of time-constant control variables
- γ_{jt} state-wave fixed effects
- ε_{ijz} error-term

References

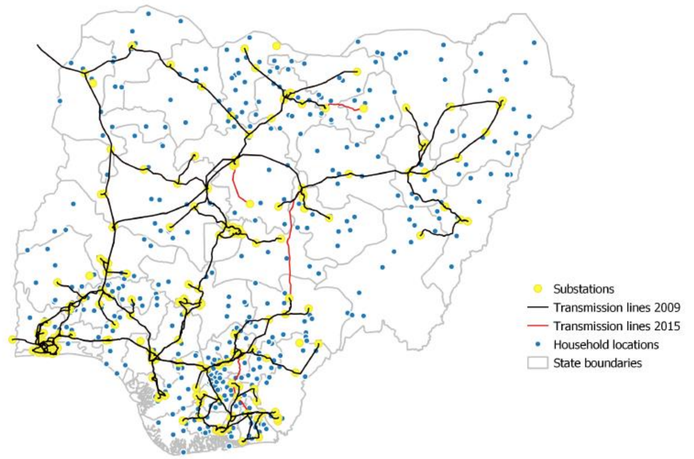
Baum-Snow, N., Brandt, L., Henderson, J. V., Turner, M. A. and Zhang, Q. (2017), 'Roads, Railroads, and Decentralization of Chinese Cities', Review of Economics and Statistics 99(3), 435–448.

Henderson, V. (2002), 'Urbanization in Developing Countries', The World Bank Research Observer 35(1), 45–45

Data

- **Energy database (Rural Electrication Agency 2020):**
- Shapeles of electric transmission infrastructure including construction year
- Location of all electric substations
- **Nigeria's General Household Survey Panel Waves 1-3 (Nigerian National Bureau of Statistics):**
- Georeferenced panel of 4,973 households tracking each HH member covering years 2009/2010, 2012/2013, and 2015/2016
- Stratication approximately at village level
- **Climate Change Initiative Land Cover Maps (European Space Agency 2019):**
- Annual gridded landcover including agricultural and urban land at 300m 300m resolution

Transmission lines, substations and household locations



Least cost instrument example

Main Results

Migration (household level)

	(1) Baseline mean	(2) Dummy grid no controls	(3) Dummy grid controls	(4) Dummy least cost grid no controls	(5) Dummy least cost grid controls
# of household members	5.963	-0.330**	-0.350**	-0.599***	-0.670***
		(0.140)	(0.150)	(0.144)	(0.161)
# of elderly	0.071	-0.061*	-0.061*	-0.033	-0.038
		(0.033)	(0.035)	(0.027)	(0.031)
# of children (total)	3.259	-0.300***	-0.325***	-0.438***	-0.502***
		(0.102)	(0.100)	(0.106)	(0.090)
# of children (age 0-5)	1.176	-0.207**	-0.223**	-0.151*	-0.219***
		(0.093)	(0.096)	(0.080)	(0.082)
# of children (age 6-12)	1.301	0.064	0.057	-0.018	-0.005
		(0.071)	(0.071)	(0.089)	(0.089)
# of children (age 13-18)	0.802	-0.137	-0.137	-0.290***	-0.290***
		(0.089)	(0.089)	(0.095)	(0.093)
Observations		2,259	2,259	2,259	2,259

Migration (individual level)

		(1) Baseline	(2) Dummy grid no controls	(3) Dummy grid controls	(4) Dummy least cost grid no controls	(5) Dummy least cost grid controls
Individual migration	All HH members	0.019	0.013	0.012	0.050**	0.051**
			(0.014)	(0.015)	(0.024)	(0.025)
	HH head	0.003	0.001	0.001	0.001	0.002
			(0.001)	(0.001)	(0.001)	(0.002)
	HH spouse	0.035	-0.016	-0.017	-0.047***	-0.048***
			(0.016)	(0.015)	(0.017)	(0.015)
	HH child	0.091	0.037*	0.035	0.096***	0.097**
			(0.021)	(0.022)	(0.037)	(0.038)
	HH grandchild	0.159	-0.004	0.022	-0.019	0.026
			(0.072)	(0.074)	(0.092)	(0.107)
	Other	0.180	-0.009	-0.023	0.031	0.037
			(0.052)	(0.053)	(0.141)	(0.142)

Employment

	(1) Non-farm work Dummy grid	(2) Non-farm work Dummy least cost grid	(3) Farm work Dummy grid	(4) Farm work Dummy least cost grid	(5) Working hours Dummy grid	(6) Working hours Dummy least cost grid	(7) Obs
All	0.001	-0.009	-0.038	-0.012	-0.530	1.185	12,808
	(0.019)	(0.016)	(0.045)	(0.061)	(1.692)	(1.593)	
HH head	0.083**	0.123***	0.013	-0.013	6.045**	8.560***	2,451
	(0.033)	(0.037)	(0.062)	(0.065)	(2.406)	(2.656)	
HH spouse	-0.025	-0.008	0.013	0.073	-3.747	2.902	2,343
	(0.068)	(0.054)	(0.066)	(0.122)	(5.112)	(4.777)	
HH child	-0.027**	-0.038**	-0.049	-0.014	-0.569	0.432	6,808
	(0.014)	(0.017)	(0.068)	(0.090)	(1.840)	(2.635)	
Other	0.060	-0.179	-0.096	0.138	1.060	4.179	308
	(0.115)	(0.295)	(0.163)	(0.310)	(5.309)	(6.342)	

Conclusions

- Positive shock to electric infrastructure lead to
  - Employment of the household head
  - No positive employment effect on children of household head
  - Instead increase of out-migration of this subgroup
- This implies closing the rural-urban gap with infrastructure investments is extremely difficult