Move on up

Electrification and internal migration

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ASSA 2021 - Online
January , 2022

Motivation

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- 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 ahs been associated with negative effects on both the sending (Baum-Snow et al. 2020) and the receiving communities (Henderson 2020)
- However, there is little empirical evidence on the effect of rural infrastructure investments on population dynamics in developing countries
- Theoretically, there are two opposing effects expected:
  - **Better earning potentials** due to the rise in productivity will reduce the incentives to migrate and will lead to a *fall* in net out-migration rate
  - **Reduction of credit constrains** due to higher household incomes will overcome one of the main barriers to migration and might lead to a *rise* in net out-migration

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?

This Paper

- Estimating the effect of new electricity transmission infrastructure on internal migration using household panel data tracking each individual of the household over time
- **Context**
  - Nigeria 2009-2016
- **Household analysis**
  - Changes in large scale infrastructure on transient households controlling for distance to substations
  - Hypothetical grid path based on least construction costs
- **Gravity model**
  - Interaction with pull factors using gravity model at municipality level

Data

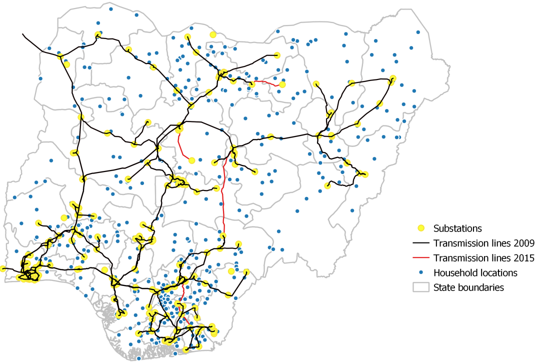

Figure: Transmission lines, substations and village locations

Model

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

$$\Delta Y_{ijt} = \alpha \Delta D_{ijt} + \beta' X_{ij} + \gamma_{jt} + \epsilon_{ijt} \quad (1)$$

  with

  - Y_{ijt} = vector of outcomes at household i, in state j, at wave t
  - D_{ijt} = binary variable indicating that household i was within 15 km of new transmission line
  - X_{ij} = time-constant geographic control variables of household i
  - γ_{jt} = state-wave fixed effects
  - ϵ_{ijt} = error term

- Identification:

$$E(\epsilon_{ijt} | \Delta D_{ijt}, X_{ij}, \gamma_{jt}) = 0, \quad (2)$$

  i.e. changes in distance to the transmission grid are exogenous conditional geographic controls and state-wave fixed effects

Model - Hypothetical least cost path

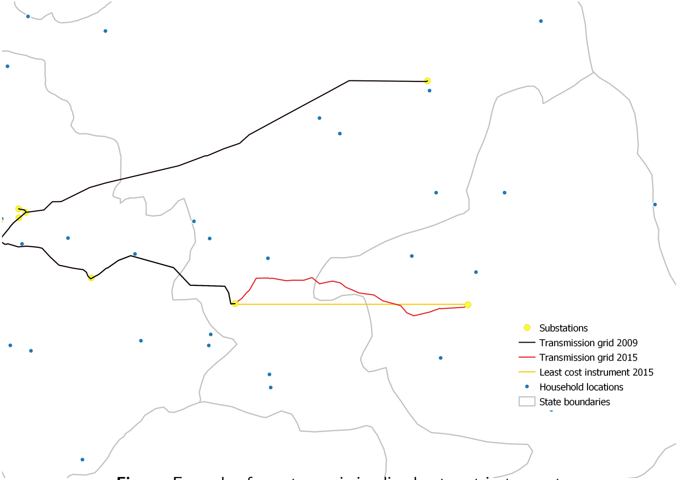

Figure: Example of new transmission line least cost instrument

Main results

Migration (household composition)

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	(1)	(2)	(3)	(4)	(5)
	Baseline	Dummy grid		Dummy least cost grid	
	mean	no controls	controls	no controls	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

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		(1)	(2)	(3)	(4)	(5)
		Baseline	Dummy grid		Dummy least cost grid	
			no controls	controls	no controls	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)

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	(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)	

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Dependent variable = $log(m_{odt})$	(1)	(2)	(3)	(4)	(5)
$Grid_{ot}$		0.001**	0.003**	0.003**	0.001**
		(0.001)	(0.001)	(0.001)	(0.001)
$log(dist_{od})$	-0.007***	-0.007***	-0.014***	-0.014***	-0.007***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
% $Cropland_{dt}$			-0.232***		
			(0.033)		
% $Urban_{dt}$				0.211***	
				(0.023)	
$Grid_{dt}$					-0.002
					(0.001)
Destination FE			x	x	x
Origin FE		x	x	x	x
Wave FE			x	x	x
Destination-Wave FE	x	x			
Origin-Wave FE	x				
Observations	1,001,556	1,001,556	498,493	498,493	1,001,556

	(1) $Grid_{ot} = 0$	(2) $Grid_{ot} = 1$	(3) Difference (2) - (1)
Panel A: Heterogenous effect of cropland			
$Log(dist_{od})$	-0.0173***	-0.0054***	0.0120***
	(0.0007)	(0.0007)	(0.0010)
% $Cropland_{dt}$	-0.2794***	-0.0938**	0.1856***
	(0.0419)	(0.0418)	(0.0592)
Panel B: Heterogenous effect of urban land			
$Log(dist_{od})$	-0.0173***	-0.0053***	0.0120***
	(0.0007)	(0.0007)	(0.0010)
% $Urban_{dt}$	0.2578***	0.0824***	-0.1754***
	(0.0293)	(0.0248)	(0.0384)
Panel B: Heterogenous effect of urban land			
$Log(dist_{od})$	-0.0094***	-0.0025***	0.0068***
	(0.0004)	(0.0003)	(0.0005)
$Grid_{dt}$	-0.0031**	0.0033*	0.0064***
	(0.0013)	(0.0019)	(0.0023)
Observations	749,232	252,324	1,001,556

Conclusion

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- 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
- Results are in line with a world where households are credit constrained and this constitutes as barrier to migration
- When productivity and incomes rise, access to credit increases and enables migration of younger household members
- Employment creation not sufficient to retain younger household members at origin
- This implies closing the rural-urban gap with infrastructure investments is extremely difficult
  - Despite large income gains, insufficient employment effects for subpopulation
  - Easing credit constrains to enable migration might be more effective in short-run
- Findings from gravity model suggest productivity shock also affected ordinal preferences for destinations