

ECON B225: ECONOMIC DEVELOPMENT

Sebastian Anti,
Assistant Prof. of Economics, Bryn Mawr College

Infrastructure

Infrastructure in Poor Countries

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- **Infrastructure is the public (shared) capital that facilitates economic activity. Examples:**
 - ▣ Ports, roads, irrigation systems, airports, train tracks, pipelines, many others
- **Infrastructure in poor countries is notable**
 - ▣ Smaller and less developed compared to rich countries
 - ▣ In worse condition compared to rich countries
- **Obvious hypothesis: Bad infrastructure $\Rightarrow$ less efficient economic activity $\Rightarrow$ lower TFP/less economic growth**



3 Figure 1: Road in Cameroon. Source: Unknown.

Difficult Relationship to Study and Measure

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- **Can't randomize who gets good infrastructure and bad or no infrastructure**
 - ▣ Generally, need to resort to other methods besides RCTs
 - Difference-in-differences, instrumental variables, other methods common
- **Obviously a larger economy will have larger and better infrastructure (reverse causality)**
- **Infrastructure development will happen in very specific places depending on their characteristics (worry about omitted variables)**
 - ▣ Example: If we want to know the effect of building a road to a village. Well, certain villages will likely get roads based on political power of the village. Likely correlated with wealth

Outline: Lee et al. 2020

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- **Motivation**
- **Research Question**
- **Data**
- **Empirical Strategy**
- **Results**
- **Conclusion**

Rural Electrification

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- **Many parts of low/medium-income countries do not have electricity**
 - ▣ 600 million in SSA
- **In many countries the electrical grid is extended, but the last hookup to the household is not present**
- **What are potential effects electricity provision might have on development?**

Motivation

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- **1/3 of World Bank spending is on infrastructure**
- **A lot of recent research on effects of infrastructure development**
- **Methodological challenges: “Often difficult to identify exogenous sources of variation in the presence of infrastructure...”**
 - ▣ This is academic jargon. What does it mean?
- **This paper looks at rural electrification (household connection to the electricity grid)**

Research Question

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- **Does connection to the electricity grid affect various outcomes? If so how much?**
 - What outcomes are they interested in?

Data and Experimental Design

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- **Population: 150 communities in Western Kenya within 600 meters of a secondary transformer**
 - ▣ 94.5 percent were not electrified
- **Sample: Random selection of 2,289 households**
- **Random selection of control group and treatment groups**
 - ▣ 3 types of treatment groups. Offer of one of the following:
 - (1) High subsidy: Free to connect to grid
 - (2) Medium subsidy: 57 percent subsidized price
 - (3) Low subsidy: 29 percent subsidized price

Empirical Strategy

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- **How are the authors claiming “identification” of a causal effect in the study?**
- **We’ll draw this on the board with the flow chart like we’ve done before**

Demand Curve Estimation Aside: What is Going on Here?

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- **You can think of the subsidy as a randomized price that the respondents are receiving**
- **With this you can look at the relationship between price and consumption**
 - ▣ What is this? This is just the good ol' demand curve from ECON 105!
- **The authors illustrate this in Figure 2 (next slide)**

Demand Curve Estimation

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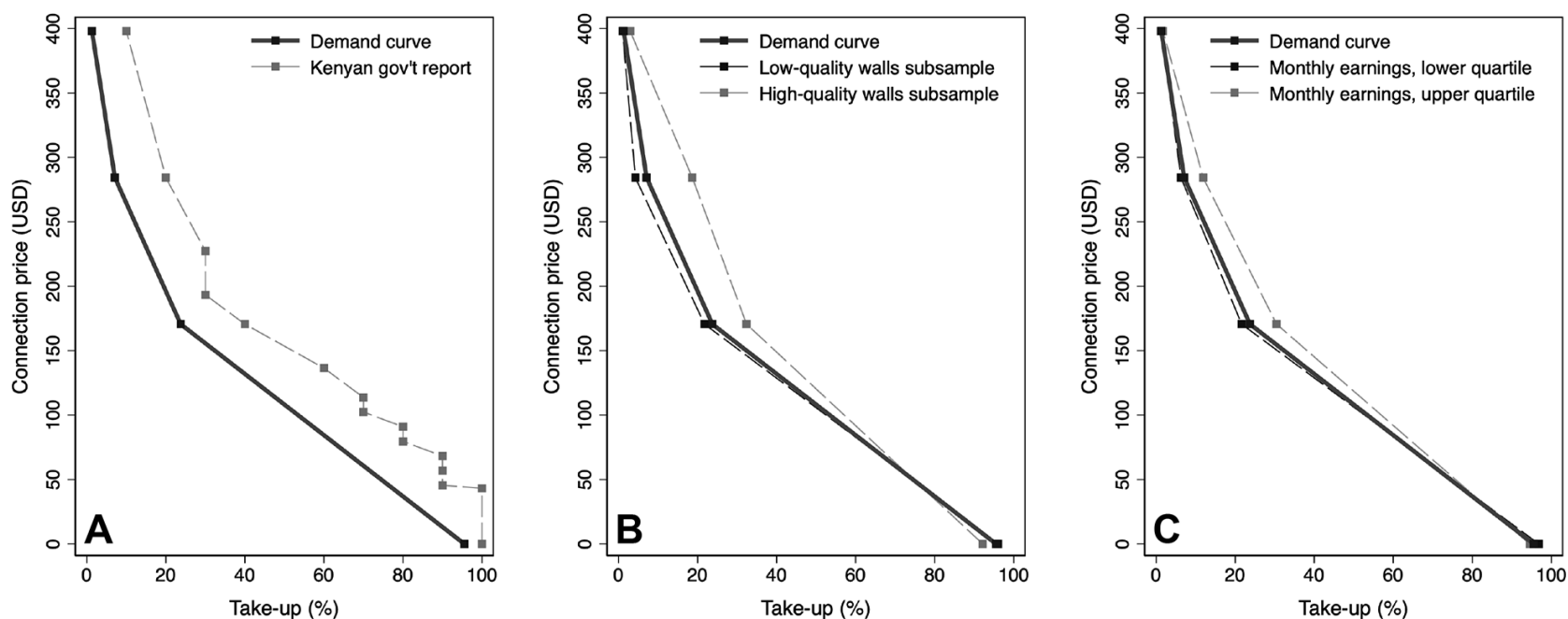


FIG. 2.—Experimental evidence on the demand for rural electrification. *A*, Comparison of the experimental results to the assumptions in an internal government report shared with our team in early 2015. *B*, Experimental results plotted separately for households with low- and high-quality walls. *C*, Results plotted separately for households in the lower and upper quartiles of monthly earnings, defined as the respondent's profits from businesses and self-employment, salary and benefits from employment, and agricultural sales for the entire household.

Estimating Consumer Surplus – Total Cost of a Mass Electrification Program

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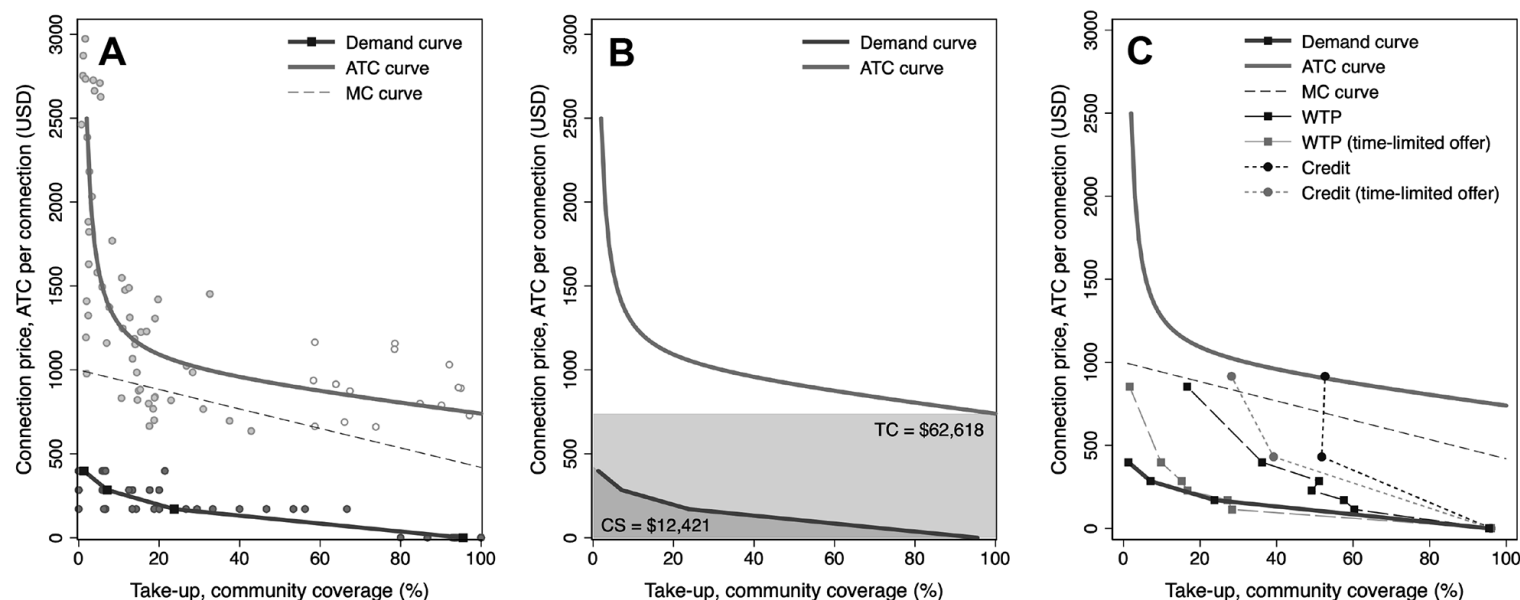


FIG. 3.—Experimental evidence on the social surplus implications of rural electrification. *A* combines the experimental demand curve with the population-weighted ATC curve corresponding to the predicted cost of connecting various population shares, based on the nonlinear estimation of $ATC = b_0/M + b_1 + b_2M$. Each point represents the community-level, budgeted estimate of ATC at a specific level of coverage. MC = marginal cost. *B* demonstrates that the estimated total cost of community electrification is \$62,618, based on average community density of 84.7 households. The area under the demand curve (consumer surplus [CS]) is estimated to be \$12,421. These estimates suggest that a mass electrification program would result in a social surplus loss of \$50,197 per community (i.e., \$593 per household). *C* combines the curves in *A* with the contingent-valuation (CV) questions included in the baseline survey. The CV questions included (1) whether the household would accept a hypothetical offer (i.e., at a randomly assigned price) to connect to the grid and (2) whether the household would accept the same offer if required to complete the payment in 6 weeks. The credit offer consisted of an up-front payment (ranging from \$39.80 to \$79.60), a monthly payment (ranging from \$11.84 to \$17.22), and a contract length (either 24 or 36 months). We plot the net present value of the credit offers, assuming a 15% discount rate. Additional details on the credit offers are provided in table B9.

Estimating Equation

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□ Paper Equation (4):

$$y_{icr} = \beta_0 + \beta_3 T_{Hc} + X'_c \Lambda + Z'_{1icr} \Gamma + s_r + \epsilon_{ic}$$

=1 if HH
offered
high
subsidy

Community
-level
controls

Household-
level
controls

Survey FE

□ What is the coefficient of interest?

□ What is the parameter of interest?

- ▣ It is interpreted as the effect of the “intent to treat” (ITT), or the *offering* of subsidized electrical hookup

Results (1)

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TABLE 3
POOLED TREATMENT EFFECTS ON KEY OUTCOMES

	Control (1)	ITT (2)	TOT (3)	FDR <i>q</i> -value (4)
A. Primary Energy Outcomes				
A1. Grid connected (%)	12.2 [32.7]	82.8*** (1.8)	...	...
A2. Monthly electricity spending (USD)	.33 [1.36]	1.80*** (.13)	2.17*** (.14)	...
B. Additional Energy Outcomes				
B1. Electricity as main lighting source (%)	10.6 [30.8]	72.0*** (2.1)	86.8*** (2.1)	.001
B2. Number of appliance types owned	2.0 [1.4]	.3*** (.1)	.4*** (.1)	.002
B3. Owns mobile phone (%)	85.2 [35.5]	−2.4 (1.5)	−2.2 (1.8)	.246
B4. Owns radio (%)	57.6 [49.4]	4.6** (2.3)	7.1*** (2.6)	.010
B5. Owns television (%)	21.3 [40.9]	9.3*** (2.8)	11.6*** (3.5)	.002
B6. Owns iron (%)	5.2 [22.2]	2.9** (1.2)	3.8*** (1.4)	.010
B7. Monthly kerosene spending (USD)	2.64 [2.75]	−.90*** (.11)	−1.00*** (.13)	.001
B8. Monthly total energy spending (USD)	10.83 [21.83]	−.36 (.99)	−.19 (1.18)	.870
B9. Solar home system as main lighting source (%)	14.1 [34.8]	−13.0*** (1.2)	−16.1*** (1.3)	.001

Results (2)

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	Baseline	1997	2007	
	C. Primary Economic Outcomes			
C1. Household employed or own business (%)	36.0 [38.4]	2.9 (2.2)	2.2 (2.5)	.619
C2. Per capita monthly household earnings (USD)	12 [42]	-1 (2)	-2 (2)	.688
C3. Total hours worked last week	50.3 [24.4]	-2.6** (1.2)	-3.5** (1.5)	.095
C4. Total asset value (USD)	1,237 [1,110]	102 (76)	117 (93)	.457
C5. Per capita consumption of major items (USD)	185 [186]	-3 (8)	-4 (9)	.721
	D. Primary Noneconomic Outcomes			
D1. Recent health symptoms index	0 [1]	-.03 (.06)	-.03 (.07)	.721
D2. Normalized life satisfaction	0 [1]	.16*** (.04)	.19*** (.04)	.001
D3. Average student test Z-score	0 [1]	-.09 (.09)	-.13 (.10)	.457

Results (3)

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TABLE 3 (*Continued*)

	Control (1)	ITT (2)	TOT (3)	FDR <i>q</i> -value (4)
D4. Average student KCPE test Z-score	0 [1]	-.12 (.13)	-.17 (.17)	.550
D5. Political and social awareness index	0 [1]	-.03 (.05)	-.01 (.05)	.861
D6. Perceptions of security index	0 [1]	.08 (.06)	.13* (.08)	.303
E. Mean Treatment Effects on Grouped Outcomes				
E1. Economic index (C outcomes)	0 [1]	.02 (.06)	0 (.07)	...
E2. Noneconomic index (D outcomes)	0 [1]	.01 (.04)	0 (.05)	...

Conclusions

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□ **Small statistically significant effects on consumption**

▣ Note the nuances here:

- The measurement of the causal effects are unbiased due the randomization
- They are statistically significant in that the data are powerful enough and the effect size is large enough to reject the idea that there is no effect with a high level of confidence
- Nevertheless, the effect size is small in a real-world sense (monthly electricity spending increases by about 1.80 to 2.17 USD)

Conclusions

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- **Effects on economic outcomes are small and/or not statistically significant**
- **Contribution:**
 - ▣ Wow! Counterintuitive
 - ▣ Perhaps subsidy is fo
 - ▣ Maybe the study is too focused on the short run and it takes longer periods of time for benefits to materialize?