Electricity and Education

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Abstract

This paper presents empirical evidence on the impact of modern energy access and reliability of energy supply on education outcomes, specifically enrollment and test scores using two waves of India Human Development Survey. Electrification studies have generally focused only on the estimating the impact on two development factors - employment and household income. This research estimates the impact of electrification on educational outcomes, more specifically, school enrollment, school attendance, being on track in school (based on age), and test scores. Our preliminary findings are:
1) The children of households that have access to electricity are more likely to enroll in school, attend school regularly, and are on track in school.
2) The children of households that have access to electricity significantly perform better than children from households that have no access to electricity.
These findings suggest that the electricity positively impacts education.

Introduction

Access to electricity is crucial for fostering human development and can be considered as a basic human right. Around 400 million Indians do not have access to electricity, which hampers their prospects of achieving higher agricultural productivity and starting non farm based business enterprises. It also affects educational outcomes of children and teenagers as limited hours of illumination impacts the time they can devote to studying. Non availability of lighted public spaces can increase the probability of crime.

Benefits from electrification are multifaceted and it is identified as an essential tool for achieving Millennium Development Goals (UNDP 2005). The individual and household level benefits of electrification have been documented by Dinkelman (2011), Rao (2013) and Ahmad, Mathai and Parayil (2014), but the focus has been on employment and income. To best of our knowledge, this is first study that aims to understand the impact of electrification on non-pecuniary development aspects. The findings of this study will provide a fuller picture of benefits from electrification.

Methods and Materials

The relationship between energy access and education outcomes is not direct and consists of several steps that are confounded by various factors; primary among them are the ones that determine electricity access in India.

Thus, taking into account the endogeneity of supply and quality of electricity in India, the relationship is estimated using the repeated cross section data from Indian Human Development Survey that spans two time periods, 2004-2005 and 2011-2012.

We estimate the impact of having access to electricity (E) on various educational outcomes (S) after controlling for ethnicity, gender, age, education level of household head and household income. Following is the empirical model that is estimated.

$$S_{cht} = \alpha + \beta E_{ht} + \gamma X_{cht} + \pi U_{ht} + \varepsilon_{cht},$$

where c=child, h= household, t=time period, and E=electricity measure (access, number of hours, and quality). X represent child specific variables and U represent household level variables that enter the empirical equation.

We present the OLS results for *Days Absent Per Month* and the ordered logit results for *Test Scores* for the rural sub-sample 2005 for age group 8 to 11 years.

Results

OLS Model
Dependent Variable: Days Absent Per Month
Sample: Ages between 8 and 11
Rural (Year = 2005)
Control Variables: HH size (log), Total Income (log), Female dummy, Age, Sex of HH head, Education of HH head

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Electricity: Yes	-1.1531*** (0.1260)	-1.1094*** (0.1269)				
Log N hrs electricity			-1.1861*** (0.1124)	-1.1739*** (0.1125)		
Electricity quality					-1.2571*** (0.1382)	-1.2063*** (0.1386)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Caste/Religion FE		Yes		Yes		Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,332	10,332	7,008	7,008	7,449	7,449
R-squared	0.2556	0.2581	0.2612	0.2650	0.2398	0.2437

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Ordered Logit Model
Dependent Variable: Test Scores (Reading/Math/Writing)
Sample: Ages between 8 and 11
Rural (Year = 2005)
Control Variables: HH size (log), Total Income (log), Female dummy, Age, Sex of HH head, Education of HH head

	Reading Model 1	Math Model 2	Writing Model 3	Reading Model 4	Math Model 5	Writing Model 6	Reading Model 7	Math Model 8	Writing Model 9
Electricity: Yes	1.7010*** (0.0783)	1.5215*** (0.0717)	1.3554*** (0.0753)						
Log N hrs elec				1.2021*** (0.0532)	0.9005** (0.0406)	1.0898 (0.0601)			
Electricity: quality							1.4223*** (0.0766)	1.0580 (0.0568)	1.2489*** (0.0841)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Caste/Religion FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,374	8,345	8,302	5,524	5,496	5,469	5,875	5,846	5,817

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Discussion

1. Three measures of electricity – access (binary), hours of electricity supply, and quality of electricity supply (1 if greater than sample median, 0 otherwise).
2. We find evidence that electrification improves educational outcomes – higher school enrollment, lower absenteeism, on track in school (age matched to grade), and overall higher test scores.
3. We also find household income and caste/religion matters for educational outcomes.
4. We find stronger patterns for female children.
5. Steps to extend our initial findings:
   - Correction for endogeneity of electricity supply
   - Selection correction for absenteeism, on track, and test scores models.
   - Estimate the impact of access to electricity in early life to educational outcomes.

Conclusions

This research contributes to our understanding of the social developmental impact of electricity by providing estimates of educational outcomes on electricity. This study will provide policy makers a more complete picture of the benefits of electrification.

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References

1. Dinkelman, T. 2011. "The Effects of Rural Electrification on Employment: New Evidence from South Africa." American Economic Review, 101(7): 3078-3108.
2. Rao, D.N. 2013. "Does (better) electricity supply increase household enterprise income in India? " Energy Policy, 57 (2013), pp. 532-541
3. Ahmad, S., Mathai, M. V., Parayil, G. 2014. "Household electricity access, availability and human well-being: Evidence from India." Energy Policy . 69, 308-315
4. United Nations. 2005. The Millennium Development Goals.