

Rural Electricity and Children's Educational Attainment: Evidence from Ethiopia

Abreham Adera¹ Raffaele Miniaci¹ Luciano Lavecchia²

¹University of Brescia and Italian Energy Poverty Observatory (OIPE)

²Banca d'Italia and Italian Energy Poverty Observatory (OIPE)

8th AIEE Energy Symposium
Padua, 28-30 November, 2024

Energy and Welfare in SDGs

- SDG 7: Access to affordable, reliable, and sustainable energy.
- SDG 4: Inclusive and equitable education for all.
- Implication: [Progress in SDG 7 supports achieving SDG 4.](#)
- Gaps in Evidence:
 - Mixed findings globally.
 - Geographic bias in existing studies.
 - Limited research in Ethiopia.

Electricity Generation in Ethiopia (2000–2021)

- In 2000, Ethiopia had only 1.7 TWh of electricity.
- By 2016, this rose sevenfold to 12.47 TWh and reached 14.69 TWh in 2021.
[database.earth](#).
- This is only 10% of the 45,000 MW of hydropower potential.

Year	Terawatt hours (TWh)
2000	1.7
2001	2.04
2002	2.07
2003	2.33
2004	2.57
2005	2.88
2006	3.3
2007	3.54
2008	3.75
2009	3.97
2010	4.99
2011	6.32
2012	7.55
2013	8.67
2014	9.47
2015	10.39
2016	12.47
2017	13.13
2018	13.79
2019	14.23
2020	14.23
2021	14.69

Child Education in Ethiopia

- Good success in **net primary enrollment**: 87 % to 104 % for first-cycle primary education (grades 1–4); 46 % to 66 % for second-cycle primary education (grades 5–8) between 2009/10 and 2016/17.
- Why such a gap for the two cycle? **87 % vs 46 % or 104 % vs 66 %?**
- **Cause: High repetition and dropout rates.**
- **Thus, achieving education-related SDGs by 2030 requires not just enrollment but ensuring education completion.**
 - Here, we study the impact of electrification not on enrollment but on completion.

Research question

Can rural electrification help child education completion?

Potential Mechanisms

● Maternal Employment (+ / -)

- **Maternal autonomy**: empowers mothers to influence household decisions (+)
- **Child labor**: a working mom can prevent it (+).
- **Information channel**: Working exposes mom to new ideas, e.g., the values of education (+).
- **Role model effect** : a working mom inspires her child (+).
- **Time poverty (-)** - No time for parental supervision and monitoring falls, & worse a child may need to attend to household tasks, and thus may withdraw from school

Potential Mechanisms

● Maternal Employment (+ / -)

- **Maternal autonomy**: empowers mothers to influence household decisions (+)
- **Child labor**: a working mom can prevent it (+).
- **Information channel**: Working exposes mom to new ideas, e.g., the values of education (+).
- **Role model effect** : a working mom inspires her child (+).
- **Time poverty (-)** - No time for parental supervision and monitoring falls, & worse a child may need to attend to household tasks, and thus may withdraw from school

● Child Labor (+/-)

- If electrification brings better jobs, parents prefer child education (-).
- Low-skilled jobs may discourage schooling or encourage child labor (+).

Potential Mechanisms

● Maternal Employment (+ / -)

- **Maternal autonomy**: empowers mothers to influence household decisions (+)
- **Child labor**: a working mom can prevent it (+).
- **Information channel**: Working exposes mom to new ideas, e.g., the values of education (+).
- **Role model effect** : a working mom inspires her child (+).
- **Time poverty (-)** - No time for parental supervision and monitoring falls, & worse a child may need to attend to household tasks, and thus may withdraw from school

● Child Labor (+/-)

- If electrification brings better jobs, parents prefer child education (-).
- Low-skilled jobs may discourage schooling or encourage child labor (+).

● Time use

- Electrification reduces time spent in firewood collection.
- Thus, reallocate it to schooling for children / to work for mothers.

Data

- We use the Ethiopian Socio-Economic Survey (ESS).
- The ESS is a collaborative project between Ethiopia's CSA and the World Bank's LSMS.
- The ESS consists of Panel I (3 rounds) and Panel II (2 rounds).
 - Panel II includes two rounds: ESS4 (2018/19) and ESS5 (2021/22).
 - Panel II is not a follow-up of the previous ESS waves.
- We use Panel I of the ESS
 - We use ESS1 (2011/12), ESS2 (2013/14), & ESS3 (2015/16).

Identification Strategy

1

**Drop Electrified in 2011:
We get 2956 non Electrified hhs**

Follow the 2956 hhs into in 2015

6.4% Electrified in 2015

**Compare Electrified vs Non Electrified by
2015**

Identification Strategy

$$\Delta y_{ih} = \alpha + \beta \text{Electrified}_{2015}^h + \epsilon_{ih} \quad (1)$$

- $\Delta y_{ih} = y_{ih2015} - y_{ih2011}$: change in child education from 2011 to 2015;
- $\text{Electrified}_{2015}^h$: change in the status of electrification from 2011 to 2015;
- i is child and h is child's household;
- ϵ_{ih} : Error term.
- β is the Diff -in-Diff estimator (see Donald, & Lang (2007).

Results: Benchmark

Table: Electrification & Child Education: Benchmark using ESS1 and ESS3

(1)	(2)	(3)
Electrified ¹	Non-Electrified ²	Diff -in -Diff ¹⁻²
2.18 (0.14)	1.74 (0.03)	0.44*** (0.14)

Notes: Robust standard errors in parentheses; *** $p < 0.01$.

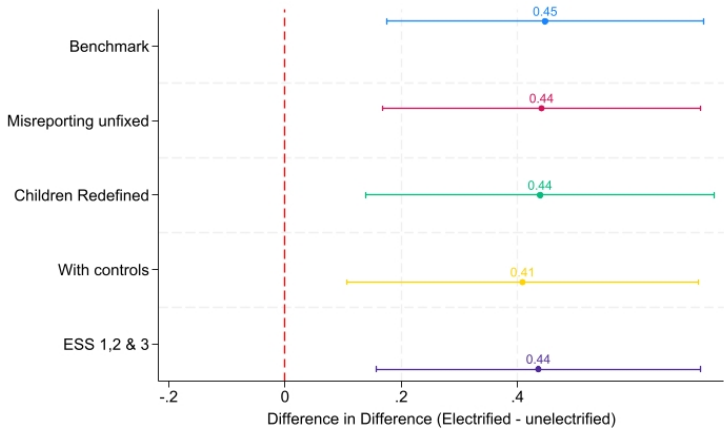
- Changes in electrification status from 2011 to 2015 increases child education by 0.44 years or 5.3 months.

Robustness Checks

Any concerns?

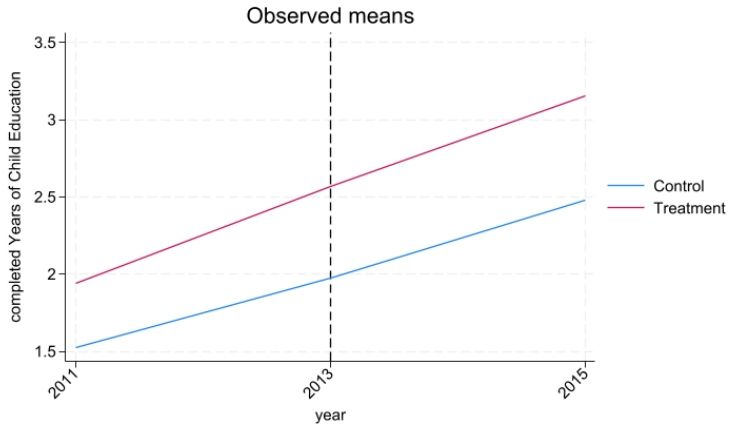
- **Systematic Misreporting?**: Those who misreport education may be systematically different from those who do not.
- **Who is Child?** We now include only those under the age of 14 as children.
- **No controls?**: Now, added village and hh F.E, child age and sex.

Robustness Checks



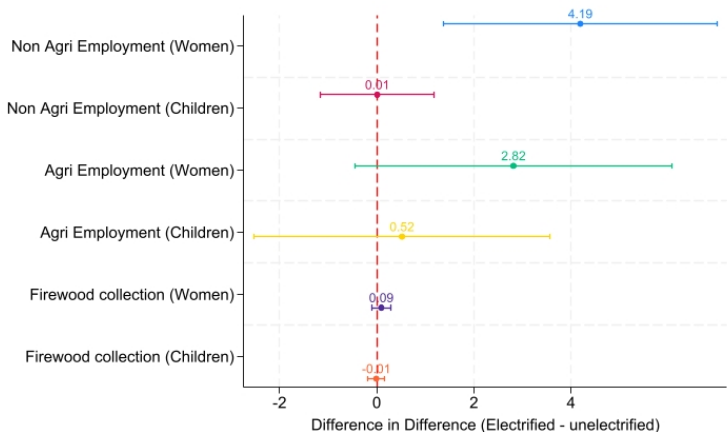
Notes: Estimated effect with 95 % confidence intervals. The estimates are also presented in Table. ??.

Parallel trends hold?



The F-statistic for differences in pre-2015 means is 1.16 (with p value = 0.28).

Mechanisms



Notes: Estimated effect with 95 % confidence intervals. Electrification only affects mother's non agricultural employment.

Conclusion

- **Does electrification improve welfare?**
 - Evidence remains inconclusive and the African context less focused.
- **Our contribution:**
 - Using diff in diff approach, we demonstrate that electricity access significantly boosts child education in Ethiopia.
 - The key driver? Mothers transitioning to non-agricultural employment.
- **Implication:**
 - Electrification policies should prioritize supporting maternal economic opportunities to maximize societal benefits.

Thank You!

I'd be delighted to hear from you.

For further questions, feel free to reach out:

abreham.adera@unibs.it