Access to electricity and children well-being: new evidence from Rwanda[1]

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Abstract

This study suggests that access to electricity in Rwanda positively affects the well-being of children, particularly among 5- to 13-year-olds, through their time allocation.

Key words: Electricity, Well-being, Children

JEL Classification Codes: I38, P18

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INTRODUCTION

Access to electricity remains a major problem in developing countries, especially in rural areas. Yet, we know that this source of energy has important benefits for a country; and this, both at the macroeconomic level (development and economic growth, poverty reduction, etc.) and at the microeconomic level (improved quality of life and productivity, social development, employment, security) [Khandker et al., 2013, Shyu, 2014]. In contrast, few studies assess the effect of access to electricity on children's well-being.[4]

In this study, we analyse how access to electricity affects children's well-being through the allocation of their time in the different activities of domestic production (production of goods and production of services) and their leisure time.[5]

We assume that the use of power tools can be a source of time savings in the production of cer- tain goods and services, which often involve child labor. If our hypothesis is true, the extra time saved in completing tasks will be allocated to leisure activities, generating better satisfaction and well-being for children.

DATA AND METHOD

We use data from Rwanda Labour Force Surveys run in February 2018. This geolocated data cover 9344 households. They are weighted to be representative of individuals at the country level, allowing us to transpose these results to the entire population of the country studied.

In order to estimate the effects of access to electricity without bias, we use the Spatial First Difference (SFD) approach introduced by Druckenmiller and Hsiang [2018] with the following specification as in Ahouangbe and Tritah [2022]:

$$\Delta Y_{ij} = \Delta X_{ij} \beta_{SFD} + \Delta Z_{ij} \alpha_{SFD} + \epsilon_{ij} \qquad (1)$$

Where Y represents a set of time allocation variables for children expressed in hours per week: home production time, distinguishing between goods production and services production, and leisure time. Unfortunately, we do not introduce children's working time due to insufficient information in the data. X is our variable of interest that takes 1 when the child is in a household with access to electricity and 0 otherwise. Z is the set of control variables, including age, household size, number of children under 13 (allowing us to control for the weight of younger siblings in time allocation), and the number of bedrooms per capita in the household. Due to the lack of information in the data, we were not able to incorporate the level of education, nor the presence of a household helper.

[4] Current studies consider children as a subgroup of the household [Khandker et al., 2013].

[5] There are three categories of time, two of which are studied here: 1) labour market time (production of goods and/or market services) 2) Domestic production time (domestic services: household chores, meal preparation, personal care, construction, etc.) (domestic goods: search for firewood, water, production of articles, etc.) 3) Leisure time (other time, games, socialization, rest, personal and academic learning). [Gronau, 1977]

The index i represents a cluster of j neighboring units (children), i.e., having a very close distance in geographic space. The index j represents the position of the neighbors in cluster i, so that j varies from 1 for the first neighbor to j the last neighbor. Delta is the difference operator. According to the SFD approach, we proceed to the first difference between a child j and its immediate neighbor $j + 1$, $\Delta Y_{ij} = Y_{ij} - Y_{ij+1}$.

The identification of the potential effects electricity access on different outcome variables is hindered by endogeneity issue leading to notable estimation biases due to the omission of important covariates that would simultaneously explain the electricity access variable and the outcomes [Dinkelman, 2011].

To overcome the lack of relevant instruments, we refer to the SFD approach. It allows us to overcome this problem of omitted covariates by exploiting the advantage of the spatial distribution of the data to estimate the causal effect of access to electricity. It is limited to comparisons between units and their nearest neighbors, and eliminates the influence of any omitted variables common to neighboring units leading to first-difference bias in the estimates. Thus, when the spatial location of the observations allows it, the exploitation of unobserved heterogeneity through non-stationary patterns in the results in space via a simple or general difference allows the omitted variable problem to be ruled out. In addition, this method produces more robust estimates when the data are organized and geographically concentrated in physical space, and when immediately neighboring units are comparable. These two elements are verified in the Rwanda data. Indeed, it is one of the most densely populated countries in Africa and the configuration of the developing world facilitates the concentration in the same space of people with similar characteristics (socio-demographic or health characteristics for example).

Even though we are studying children, our neighbor clusters are done at the household level. And once the neighboring households are identified and clustered, it becomes easy to identify the neighboring children, and thus make the comparison between a child in household (j) and the child in the neighboring household ($j + 1$). Since within a household there can be several children, but we only need to compare one child with its neighbor, we create an analysis sample by randomly drawing one child from each neighboring household.

To have robust results, we proceed to 100 random resamples. For each resampling, we estimate the β_{SFD}. Inspired by Bootstrapping, the following formula allows us to obtain a mean estimate with $\hat{\beta}^{m}_{SFD} = \frac{1}{n}\sum_{i=1}^{i=n} \hat{\beta}^{i}_{SFD}$ with standard error $se\left(\hat{\beta}^{m}_{SFD}\right) = \frac{1}{n}\sum_{i=1}^{i=n} se\left(\hat{\beta}^{i}_{SFD}\right)$.

To optimize the selection of immediate neighbors in a physical space where neighbors are randomly distributed, we build an algorithm for selecting and clustering neighbors in longitude and then in latitude. The longitude clustering process selects in a longitudinal direction (0° angle neighbors) and the latitude clustering process in a latitudinal direction at (90°). The comparison of the results of these two clustering processes allows us to validate the robustness of our results.

RESULTS

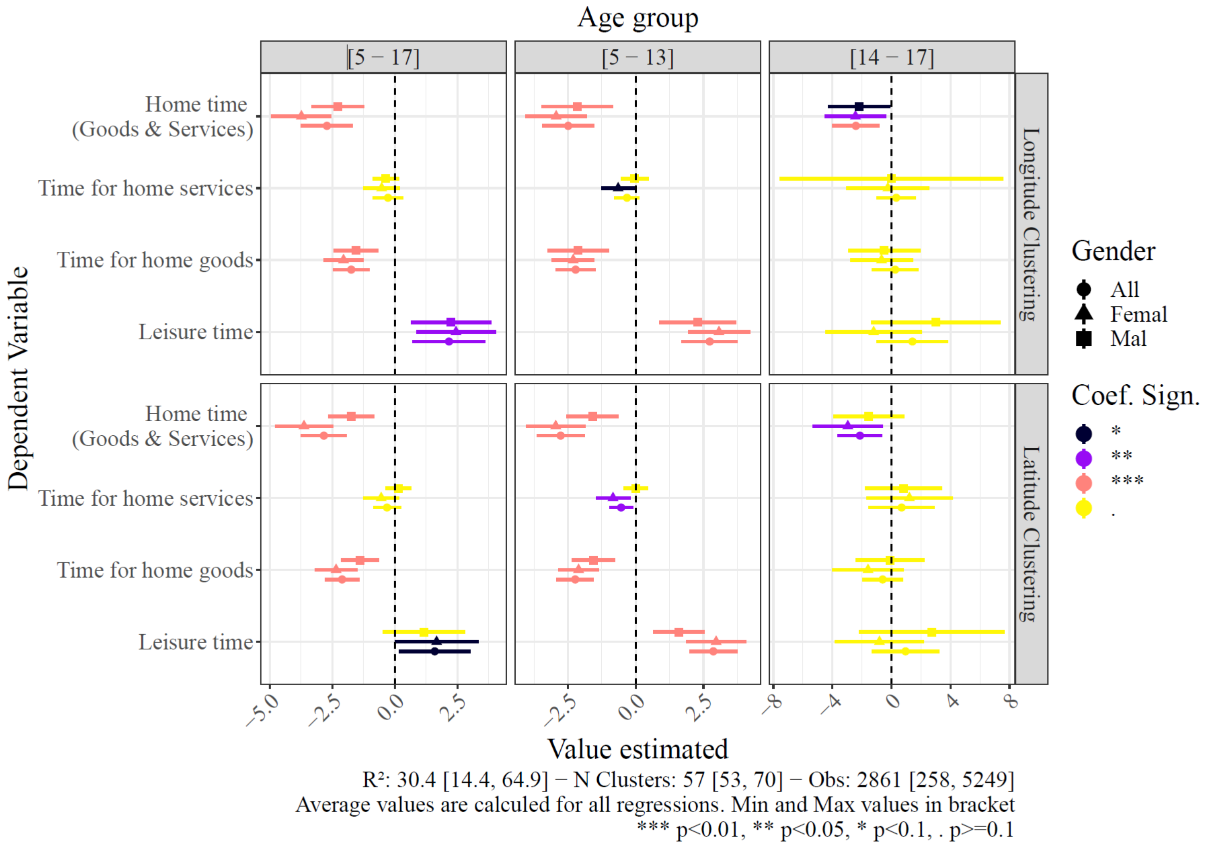

Figure 1: Electricity effects (CI of 95%)

The results are presented in Figure 1, by gender, clustering process, age group for each of the time allocation variables.

Overall, for children (5-17 years old), access to electricity leads to a significant difference in the distribution of leisure time and time allocated to domestic production: particularly for the production of goods, but not for the production of services. Access to electricity is associated with more leisure time (about 2.5 hours more per week) and less home production time (about

2.5 hours less per week). For children aged 5 to 13, the results are similar to the previous ones and with larger magnitudes. This shows that children in this age group are the most positively impacted by access to electricity. These results can be explained by the acquisition and installation of electrical household appliances for cooking and storage and the elimination of certain activities for children who receive electricity compared to those who do not. For children aged 5 to 13, the additional time gained from the decrease in home production time is transferred to their leisure time, since at these young ages, few of them engage in market activities.

Note, however, that for the 14-17 year old category, access to electricity only reduces time spent on domestic work, not time spent in the labor market. The additional time they gain through access to electricity is not reallocated to leisure; it would be necessary to verify whether this time is transferred to the labor market for this age category. The results follow the same patterns for both girls and boys, and are robust regardless of the type of clustering or neighborhood chosen.

Finally, with regard to service production time, the non-significant difference between beneficiary and non-beneficiary children can be explained by the lack of participation of the children in service production activities.

CONCLUSION

This study analyzes how electricity affects children's well-being via their time allocation.

Using 2018 Rwanda labor force survey data, we implement the Spatial First Difference approach, allowing us to exploit the advantage of the spatial distribution of the data to estimate the causal effect of access to electricity. The results are robust to the choice of children and neighbors.

Our results show that access to electricity decreases children's domestic work time. This decrease is essentially explained by a significant reduction in the time spent producing domestic goods through the acquisition of household electric tools, but not by the time spent producing services. The latter category mainly includes activities that are mostly performed by adults. Moreover, for children aged 5 to 13, this decrease translates into more time spent on leisure. The results are similar for girls and boys.

The acquisition of this additional time through access to electricity means that children can spend more time on activities necessary for their development such as education, socialization, learning, resting, and acquiring information through the media. The accumulation of these activities allows the child, but also the family, to increase its health, its well-being, but also its future possibilities. A panel study to verify the cumulative effect of access to electricity on the evolution of well-being, education and health would be relevant.

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