



Rural electrification, gender and the labor market: A cross-country study of India and South Africa



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ABSTRACT

This cross-country study estimates the effect of household electrification on labor market outcomes for rural individuals in India and South Africa, two developing countries that have implemented large-scale rural electrification schemes in recent decades. Two identification strategies are used: propensity score matching and panel fixed effects estimation. We focus on three indicators of labor market success: employment, earnings and hours worked. We find that electrification raises the annual incomes earned by those who work in paid employment, for both men and women in both countries. For India, both genders work fewer hours, suggesting that electricity raises productivity. For South Africa, where the labor market has less absorptive capacity, there is no employment benefit of electrification. But women who work benefit the most from the productivity gains of electrification: they have greater increases in earnings than men. Our findings suggest that the benefits of electrification do not accrue universally, but rather depend on gender roles, supporting policies and the labor absorptive capacity of the economy.

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1. Introduction

The role of electricity in driving growth and development has been an area of much debate over the last few decades. Recently, ensuring that all individuals have access to affordable and reliable sources of modern energy was explicitly set out as one of the United Nations' Sustainable Development Goals. While industrialized nations have prospered from the pervasiveness of electricity, electricity access is lacking in many developing countries, with the problem being particularly chronic in rural areas. Around 45 percent of rural households in India (Census, 2011a) and 24 percent of the rural population of South Africa (Census, 2011b) do not have access to electricity. For many households that do have electricity, reliability of supply and affordability remain major issues. To this end, rural electrification programs with an aim to achieve universal access to electricity have been launched across many developing countries, such as the *Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)* scheme in India and post-apartheid electrification drives in South Africa. The role and intent of these electrification programs is not only to provide access to electricity but also to improve the quality of life of impoverished and remote rural communities (Khandker, Samad, Ali, & Barnes, 2014). However, Barnes

and Binswanger (1986) highlight the more wide-ranging 'blind faith' often placed on rural electrification to solve all problems faced by rural people. They note that "advancing power lines into rural areas has been synonymous with providing the necessary infrastructure for bringing rural areas quickly to higher levels of development".

However, while electricity is a pre-condition to economic development, it is not the only policy lever to achieve development and poverty reduction, and requires other complementary inputs in order to be effective. In spite of the recent electrification programs, there are limitations to the evidence of the impacts of rural electrification on economic outcomes such as employment and wages. In addition to some research being inconclusive, most studies analyze a single country or single program, which makes them difficult to generalize to other developing country contexts. To counteract this, we employ a cross-country comparative methodology in two major developing countries, namely India and South Africa, using two identification strategies and recent data to ascertain the causal impacts of rural electrification on labor market outcomes. Rural electrification has often been promoted as a key means of uplifting women, in particular, and thus our study views the impacts of electrification through a gendered lens.

The analysis is conducted in the form of a comparative study in order to provide insight into the mechanisms by which electrification generates labor market effects. Both countries have

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Table 1
Rural electrification schemes in India and South Africa.

Schemes	Time period	Features
India		
Rural irrigation projects/rural electrification projects	1951–1956	Targeted village level electrification and irrigation
Rural Electrification Corporation	1969	Created to energize pump-sets and provide electricity to villages
Minimum Needs Program	1974–1978	Targeted village level electrification
Kutir Jyoti Program (KJP)	1988–2004	Provided single point light connection (60 W) to Below Poverty Line households. Merged with RGGVY in 2005
Pradhan Mantri Gramodaya Yojna (PMGY)	2000–2005	Provided financial assistance for minimum services (including rural electrification)
Minimum Needs Program (MNP)	2000–2004	Targeted villages with less than 65 percent rural electrification with 100 percent loans for last mile connectivity. Merged with RGGVY in 2005
Accelerated Rural Electrification Program (AREP)	2002–2012	Provided interest subsidy of four percent to states, through approved financial institutions, for rural electrification programs
Rural Electricity Supply Technology Mission (REST)	2002–present	Ensuring electrification of all villages and households through local renewable energy sources and decentralized technologies
Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY)	2005–2014	Targeted 100 percent rural electrification and electricity access to all households. Replaced by DDUGJY
Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)	2014–present	To provide continuous power supply to rural India
South Africa		
National Electrification Programme (NEP)	1994–2001	Aimed to provide electricity access to households that had not had access during apartheid
Integrated National Electrification Programme (INEP)	2001–2010	Focused on rural electrification, as urban electrification had dominated the previous NEP
Integrated Resource Plan (IRP)	2010–present	Emphasizes the use of more renewable energy sources, especially in areas that are not grid-accessible

Source: Compiled by the authors

experienced large-scale electrification programs in recent decades, which have substantially increased household access to electricity, although rural areas remain under-serviced. However, the labor markets in the two countries are very different, in terms of features such as access to employment, types of work, and the distribution of earnings. If the study finds that the impact of electrification is similar in both countries despite these large differences, then it is likely that the conclusions are quite generally applicable. In contrast, if outcomes differ in the two countries, then the impacts of electrification programs are location and case-specific, and must be evaluated on a case-by-case basis. A cross-country comparison of how access to electricity affects labor market outcomes therefore enhances our understanding of the causal links between electrification and wellbeing. Of particular interest is the extent to which rural electrification affects employment and earnings for women, and thus, promotes inclusive and sustainable growth.

The paper uses two key identification strategies in order to assess the causal effect of rural electrification and to assess the robustness of the findings. First, a propensity score matching method is used at a cross-sectional level to compensate for the lack of a selection rule for randomizing households into treatment (household electrification) and control groups. Second, unobserved heterogeneity that may be correlated with both household access to electricity and labor market success is corrected by applying panel data analysis techniques. The panel estimates produced through fixed effects estimation therefore provide the most reliable and informative results.

The key findings of the paper are that the effects of electrification are not universal: access to electricity improves some labor market outcomes, but the nature and extent of the impact differs across labor market indicators, gender and estimation method. The most robust finding is that access to electricity raises the annual incomes earned by those who work in paid employment, for both men and women in both countries. For India, this is accompanied by a decrease in hours worked for both genders, suggesting that electricity raises productivity. Men who gain access to electricity have a decreased probability of working in paid employment. For South Africa, there are no employment effects of electri-

fication, which is consistent with a labor market with less absorptive capacity. But women have greater increases in earnings once employed than men, suggesting that they benefit the most from the productivity gains of electrification.

The remainder of the paper is structured as follows. Section 2 briefly outlines the electrification programs that have taken place in both countries, and the nature of the countries' labor markets. This section provides the context in which the labor market effects of electrification will be studied. Section 3 reviews the existing literature on the impacts of electrification, while Section 4 outlines the research methods used in the paper. The data used for the study are discussed in Section 5, which also presents descriptive statistics of individuals living in electrified and non-electrified rural households. The econometric estimates are presented thereafter, focusing on the impact of rural electrification on three key labor market outcomes: employment status, hours worked and earnings. Propensity score matching estimates are shown in Section 6, with panel analysis conducted in Section 7. Finally, Section 8 discusses the results and concludes the study.

2. Background

2.1. Rural electrification in India and South Africa

Rural electrification has been high on the agenda for policymakers over the past several decades. In India and South Africa, a sequence of electrification programs have addressed the varying needs of each country over time, as outlined in Table 1. Early electrification schemes in India focused on productive uses such as irrigation, before expanding into providing basic access for poor households (the *Kutir Jyoti* program). More recent schemes have centered on renewable energy and universal access. The current *Deen Dayal Upadhyaya Gram Jyoti Yojana* scheme, in place since 2014, focuses on improving the reliability of supply in rural India (GOI, 2017).

In South Africa, electrification became a priority after the advent of democracy, in line with the refocusing of many other

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