

# Rural Electrification and Household Labor Supply: Evidence from Nigeria

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**Summary.** — In Nigeria, the most populated African country, rural electrification is a critical issue because of the low household electrification rate and the poor quality of the grid. This energy poverty has harmful economic and social consequences in rural areas, such as low productivity, lack of income-generating opportunities and poor housing conditions.

In this paper, we consider electrification as a technical shock that may affect household time allocation. Using the 2010–11 General Household Survey, we investigate how electrification affects female and male labor supply decisions within rural households in Nigeria. Focusing on husband–wife data, we consider potential dependence in spouses' labor supply decisions and address the challenge of zero hours of work using a recent copula-based bivariate hurdle model (Deb *et al.*, 2013). In addition, an instrumental variable strategy helps identify the causal effect of electrification.

Our results underline that this dependence in spouses' labor supply decisions is critical to consider when assessing the impact of electrification on these outcomes. Electrification increases the working time of both spouses in the separate assessments, but the joint analysis emphasizes only a positive effect of electrification on husbands' working time. In line with the household labor supply approach, our findings highlight that, within the household, the labor supply decisions of one spouse significantly affect those of the other spouse. Thus, if we neglect the effect of electrification on the spouse of the individual examined, we may fail to assess how this individual has been actually affected by this common shock on both spouses. Our results suggest that these within-household relationships promote husbands' working time at the expense of wives' working time.

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**Key words** — rural electrification, labor supply, developing countries, joint decision making, bivariate hurdle model, copulas

## 1. INTRODUCTION

Electrification is an important challenge for economic and social development in developing countries and especially in Africa, which has the lowest electrification rate in the world. In Nigeria, the most populated African country, rural electrification is a critical issue because of the low household electrification rate and the poor quality of the grid. In 2015, only half of the whole population and one-third of the rural population had electricity. Even when connected to the grid, most urban households experience blackouts every day and most rural households have only a few hours of electricity per day (Aliyu, Ramli, & Saleh, 2013). This energy poverty has harmful economic and social consequences in rural Nigeria. Firms using electrical capital goods cannot locate in non-connected areas, which limits income-generating activities for the rural population and increases both underemployment and poverty. An inadequate supply of electricity is considered by both households and entrepreneurs as a major constraint to improving welfare and developing business (ADB, 2009). As a consequence, many rural households migrate to cities and firms are concentrated in connected areas.

In the literature, electricity consumption is widely presented as a growth factor (see Ozturk, 2010; Payne, 2010). According to the electricity-led growth hypothesis, policymakers could boost productivity and growth by expanding electricity supply. In Nigeria, Iyke (2015) shows that electricity consumption is a fundamental driver of economic growth, which can contribute to enhanced societal welfare through job creation and poverty alleviation. A recent strain of empirical literature focuses on the microeconomic consequences of electrification on the labor market in developing countries. Most studies highlight that (rural) electrification positively affects labor

supply especially of women, who are encouraged to move away from domestic work and participate in the labor market. In South Africa, Dinkelman (2011) shows that rural electrification significantly increases female employment but has no effect on male employment. Grogan and Sadanand (2009, 2013) and Grogan (2012) outline a similar increase in female employment following household electrification in Nicaragua, Guatemala, and Colombia, respectively. In Bangladesh, Chowdhury (2010) also shows that electrification increases the employment probability of women while it simultaneously decreases the total time that women spend on unpaid work. In rural Peru, Dasso and Fernandez (2015) show that electrification has different effects on the employment decisions of men and women—men are less likely to have a second job, whereas women are more likely to participate in the workforce, especially as self-employed—but a common positive effect on their working time.

Following this emerging strain of literature, we propose to assess, for the first time, the impact of electrification on male and female labor supply in Nigeria, where rural electrification is a critical issue. We contribute to the extant literature by addressing two empirical shortcomings of previous studies. First, these studies rely on the implicit but questionable assumption that males and females make their labor supply decisions independently within the household. The majority of the empirical studies in the household labor supply literature (Chiappori, 1988, 1992) considers that male and female

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working time should be analyzed jointly among married couples (Huffman & Lange, 1989; Zhang, 2014). Second, some authors identify a causal effect of electrification on employment probability but fail to specify the effect on working time. For this purpose, we rely on matched husband–wife data from the 2010–11 General Household Survey (GHS) and analyze spouses’ labor supply outcomes simultaneously, in the form of participation and time allocation in the labor market, using the bivariate hurdle model proposed by Deb, Trivedi, and Zimmer (2013). We identify the causal effect of electrification on both labor supply outcomes using an instrumental variable strategy.

The rest of this paper proceeds as follows: Section 2 discusses the effects of household electrification on employment in rural areas. Section 3 describes the context of electrification in Nigeria. Section 4 describes the Nigerian household survey data, as well as the data processing and summary statistics. Section 5 outlines the different econometric specifications. In Section 6 we examine the effects of household electrification on husbands’ and wives’ labor supply, first separately and then jointly. Section 7 concludes.

## 2. EXPECTED EFFECTS OF ELECTRIFICATION ON EMPLOYMENT

Electrification induces changes in the nature and the amount of work done by households both at home and in the market. Electricity provision can be interpreted as a technical shock that can affect labor outcomes through different channels. Figure 1 proposes a synthetic view of the channels that have been identified in the literature (Dinkelman, 2011; Akpan, Essien, & Isihak, 2013; Kanagawa & Nakata, 2008; Rao, 2013). Individuals’ labor outcomes depend on both their labor

supply and firms’ labor demand. Thus, for a comprehensive understanding of how electrification may affect labor outcomes, we have to consider its effects on both sides of the labor market.

On the demand side, rural electrification may have a positive effect by fostering business creation, job creation and sectoral diversification of activities. In addition, connected firms are expected to be more productive, potentially increasing wages and profits. In contrast, rural electrification may also cause a decrease in labor demand by causing electricity-intensive inputs to be substituted for labor-intensive inputs. The labor demand increase is not necessarily the same for women and men, assuming they do not specialize in the same occupations. For instance, it could be relatively higher for women in an area that develops textile manufacturing, because this sector is generally more intensive in female-labor input.

On the supply side, electrification may have a positive effect mainly through an increase in the household time endowment. Electrification enables people to save time on domestic chores or provides them additional time each day. Lighting is the primary use of electricity in rural households (Kohlin, Sills, Pattanayak, & Wilfong, 2011), which enables households to extend the day, and thereby the potential working day, with artificial light. Electrification might also enable households to increase the efficiency of domestic chores (e.g., cooking, water and fuelwood collection, laundry, childcare) through the use of electrical appliances (e.g., cooker, sewing machine, water pump, refrigerator). This release of domestic time provides people with an opportunity to increase the time devoted to the labor market or simply to start working. Because domestic chores are mainly carried out by women, their labor supply might seemingly be more powerfully impacted by electrification than that of men. This relationship is neither guaranteed nor trivial. First, it relies on the actual use of electrical

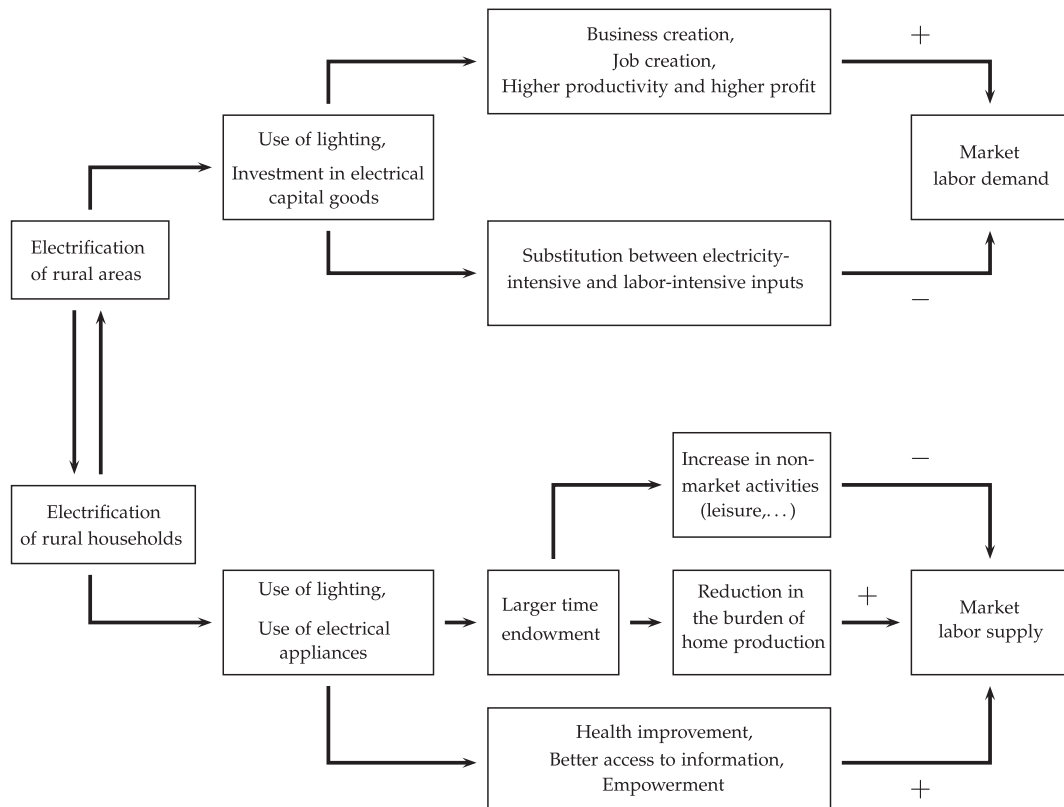


Figure 1. Expected effects of electrification on employment

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