

IDE Research Bulletin

Research Summary based on papers prepared for publication
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Impact of Rural Electrification on Fertility in Bangladesh

Project Organizer

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Title of the Project:

Impact of rural electrification on fertility in Bangladesh

Abstract:

We used a household panel dataset from Bangladesh to examine the relationship between fertility and the adoption of electricity where the latter is instrumented by the quality of service delivery. We find that the adoption of electricity reduces the fertility by one child or more. This finding is robust to the choice of covariates, estimation methods, and various measures of electricity adoption. Our finding is also consistent with our simple household model in which adoption of electricity affects only the optimal number of children but not necessarily current fertility behavior if the optimal number has not yet been reached. In the second analysis, we offer micro-econometric evidence for a positive impact of rural electrification on the nutritional status of children under five as measured by height-for-age Z-score (HAZ) in rural Bangladesh. In most estimates, access to electricity is found to improve HAZ by more than 0.15 points and this positive impact comes from the channels of increased wealth and reduced fertility, even though the evidence for the latter is weak. We also analyze the causal channels through the local health facility and exposure to television. We find no evidence for the presence of the former channel and mixed evidence for the latter.

Period:

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Members of the Research Project:

Organizer: Abu S. Shonchoy (Research Fellow, Micro-economic Studies Group, Development Studies Center)

Co-Researchers: Tomoki Fujii (Associate Professor, Singapore Management University), Sijia Xu (PhD Candidate, Singapore Management University)

Aim of the Project:

Using secondary household surveys and other community-level data sets, we investigate the impact of the rural electrification program on fertility and other socio economic indicator in Bangladesh. While there have been a few studies on the relationship between rural electrification and fertility, previous studies suffer from a number of problems, including the potential

endogeneity of the adoption of electricity. This problem is important because those households that adopt electricity may be systematically different from others. We also try to disentangle the effects of electrification at the household level and access to electricity at the village or district level. This, in turn, helps us to identify the channels through which rural electrification affects the fertility and other socio economic behaviour. This study is also likely to bear some implications relevant to the formulation of policies for rural electrifications and family planning and also might shed light on other indirect impacts of electrification on rural households.

Background of the Research:

Rural electrification remains an important issue to be addressed in many poor countries. As of 2009, about 500 million people are estimated to be living without electricity in South Asia (International Energy Agency, 2011). While electrification alone may not resolve the energy access problem as argued by Bhattacharyya (2006) for the case of India, it may bring about a number of economic benefits beyond making electricity available to people. In a recent study, Khandker et al. (2009b) estimate that the gain in total income due to electrification is between 9 to 30 percentage in Bangladesh. Positive economic effects are also found in India (Rud, 2012), South Africa (Dinkelman, 2011), and Vietnam (Khandker et al., 2009a). One exception is Rwanda in which effects of electrification on income are found insignificant once regional differences are accounted for (Bensch et al., 2011).

Despite its importance, there are only a handful of studies undertaken by economists on the social aspects of the impact of rural electrification. In this study, we primarily focus on the impact of rural electrification on fertility in rural Bangladesh. There are at least four reasons why electrification may affect fertility and other socio-economic behaviour. First, electrified households enjoy extended light hours, which can be spent on work and leisure activities. This in turn leads to reallocation of productive and unproductive activities. Second, there may be opportunity to empowerment of women which is directly associated with electrification. For example, women may be able to obtain information about reproductive health from radios and televisions which could help them to change their preference for work and fertility. Electrification may also reduce or remove the relevance of men's physical strength and other behaviours. Third, electrification increases the household demand for electricity-related goods, which may compete with the expenditure on other goods like child-related expenditures. Fourth, electricity may directly improve the standards of medical services by enabling doctors and paramedics to use electricity-operated medical equipment, which in turn may have considerable effect on the fertility behaviour.

While there have been a few studies on the relationship between rural electrification and fertility, previous studies suffer from at least four important problems. First, most of studies discussed above are based on aggregate data and thus ignore the heterogeneity across households. In particular, the endogeneity of the adoption of electricity is ignored in these studies, which cast

serious doubt on the validity of the analysis. Second, earlier studies cited above tend to suffer from small sample sizes and arbitrary sampling. Third, most of the studies mentioned above only use the availability of electricity as an indicator and ignore the length of exposure to electrification. This is important particularly when we analyse the data at the household-level, because the effect of electrification is unlikely to be significant if the length of time during which the household is electrified is short. Further, there may be declining marginal effect of the duration of electrification, a point generally ignored in the literature. Fourth, none of these studies satisfactorily separate the effect of electrification at the household and village or district (community) levels.

The main expected contribution of this study is to address all of the four problems using the data and estimation methodology approach detailed below in section 4) of this proposal to contribute to the growing body of literature on the relationship between a specific type of infrastructure and development. For example, Duflo and Pande (2007) show that dams tend to increase rural poverty where they are built but decrease it in downstream in India. There have also been studies on transportation infrastructure (Fernald, 1999; Banerjee et al, 2012) and telecommunications infrastructure (Röller and Waverman, 2001) and a number of other studies (see, Gramlich (1994) and Straub (2008) for a review of literature). Because most of these studies investigate economic impacts, this study makes a unique contribution by shedding light on demographic impacts and has a potential to ignite a series of new studies, which rigorously analyse social impacts of infrastructure.

Paper 1: Fertility and Rural Electrification in Bangladesh

Access to electricity is essential for development. Provision of welfare-enhancing utilities such as clean water supplies, improved sanitation, and modern health care services can be delivered efficiently with electricity. Electricity enables households to enjoy reliable and efficient lighting and heating equipment, improved cooking facilities, robust mechanical power, better transport and telecommunications services, and an overall modern lifestyle. Unfortunately, approximately 1.3 billion people in developing countries currently lack basic access to electricity,¹ particularly in rural areas. Approximately, half of this un-electrified population lives in Asia, primarily in South Asia.

One relatively unexplored impact channel of electrification is on fertility. There exist several plausible causal links to have such an impact channel of electrification. First, access to electricity may change consumption patterns. As it enables households to enjoy an array of electric appliances, it may also induce households to shift resources away from child-related goods to the goods that could be operated using electricity. Second, access to electricity also alters the way time is used, because households can now use additional lighted hours for productive purpose or

¹ WEO 2014 Electricity Access Database (Accessed on July 31, 2015).

may watch TV instead of engaging in reproductive activity, for example. Third, electrification may also change the income opportunities available to households. This, in turn, alters the opportunity cost of time, especially for women. Finally, electricity enables households to have better access to information and telecommunication facilities, which may further change their fertility patterns.

Fertility link of electrification is very important, especially for developing countries, as high fertility rates may result in a lack of human capital investment, which in turn reduces the quality of human resources and may lead to youth unemployment. In the development literature, high fertility is regarded as one of the most important factors hindering long-term economic development (See, for example, Ashraf 2013). However, academic literature in economics paid little attention to this link, as there exist only a handful of studies on the impact of electrification on fertility.

To address this lacuna in the research, we rigorously examine the relationship between fertility and the adoption of electricity using a panel dataset from Bangladesh. We find that electricity adoption and fertility are negatively correlated after controlling for observables. Using infrastructure development and quality of service delivery as instrumental variables for electricity adoption, we find that the adoption of electricity leads to a reduction in fertility.

This paper makes a few noteworthy contribution to the literature. First, we use a unique panel data-set to investigate the impact of rural electrification. This is important because the subsequent fertility behavior is heavily dependent on current number of children. Second, unlike a number of existing studies, we address the endogeneity of electricity adoption by exploiting the exogenous variations in the infrastructure development and service delivery. Third, we use a bivariate ordered probit model to address the discreteness of fertility behavior, which does not need to impose a rigid structure unlike the Poisson model. Finally, we develop a simple household model, which allows us to make a joint prediction on the direction of change in fertility, time use, and consumption of non-child goods.

Paper 2: Fertility and Rural Electrification in Bangladesh

Access to electricity can potentially play a significant role in poverty reduction and the promotion of economic growth in developing countries. It is an essential element for the adoption of information and communications technology, provision of improved education and health care services, and a range of industrial activities. Moreover, extended lighted hours allow people to engage in various gainful activities—especially at night—which enable more flexible use of time. While recent decades have witnessed a significant expansion in access to electricity, the electricity supply coverage still remains low in many parts of the developing world.

Recognizing the importance of electrification for rural development, Bangladesh established the Rural Electrification Board (REB) as early as 1977 to provide access to affordable and reliable

electricity in rural areas. However, because of a lack of resources and capacity, the availability of electricity in rural areas has been severely limited in Bangladesh. As of the year 2000, only 21 percent of rural households had access to electricity in Bangladesh. However, the pace of electrification has substantially accelerated over the last decade. As of 2014, 51 percent of rural households had access to electricity from the national grid. Once electricity from solar power is included, the proportion of electrified households in the rural area rises to 65 percent.

This significant improvement in the access to electricity has been accompanied by a noticeable improvement in the status of child nutrition. In the year 2000, about 47 percent of rural children under five were stunted, or abnormally short for their age and gender. The prevalence of stunting in rural areas dropped to 38 percent in 2014.

While the spread of the access to electricity and improvement in children's nutritional status may have simultaneously occurred by just pure coincidence, there are at least four reasons to believe that a causal relationship may exist between them. First, access to electricity may create new income opportunities. As a result, households may be able to have more and better food and medication, which in turn leads to better nutritional status. Second, access to electricity allows people to use lights at night, which enables them to engage in gainful activities that were previously difficult. This in turn may reduce fertility and improve the nutritional outcome through the effect of the quantity-quality trade-off for children. Third, the quality of the health care service provided in local clinics and hospitals may improve as a result of electricity access, because much of the basic equipment in modern medicine requires electricity. Finally, nutritional status may improve through the spread of information. In particular, mass media such as television could act as a powerful device for spreading important information about child care and nutrition to rural households.

Using three rounds of the individual-level Bangladesh Demographic and Health Surveys (BDHS) data, we investigate the impact of rural electrification on the nutritional status of children under five. To address the potential endogeneity of the households' access to electricity, we adopt the instrumental variable (IV) approach whereby the electrification is replaced by indicators of infrastructure development and quality of service delivery. Our results confirm that rural electrification positively affects child nutritional status in Bangladesh. We also investigate other plausible causal channels. Our empirical results show that the household's wealth and fertility explain at least some of the positive effect, though the evidence for fertility is weak. However, we find no evidence that the positive impact of electrification is channeled through the local health facilities. We do, however, have inconclusive evidence for the existence of causality through the channel of exposure to television. To the best of our knowledge, this is one of very few studies of the impact of rural electrification on the nutritional status of children and the first study to analyze four distinct channels of causality going from electrification to child nutrition.

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