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Quantifying slum electrification in India and explaining local variation

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ABSTRACT

Unreliable electricity supply is a major obstacle to economic development in countries such as India. While electricity problems in the rural areas are widely recognized, scholars have yet to analyze the situation in urban slums. Drawing on 2004–2005 survey data from the India Human Development Survey, we document the electricity situation in slums. We find that while households located in slums are less likely to have access to the electricity grid than other urban households, the situation is significantly better than in rural areas. Based on simulations, we find that a median household in a slum has 70% chance of having electricity. This number decreases to 50% for a household in a rural area and increases to 80% for households in urban areas. As to daily hours of electricity available for connected households, urban slums also fall between other urban and rural areas. Finally, we show that these conditions vary considerably by state. Slums located in states with low corruption and leftist governments have better electricity access on average than those in states suffering from corruption or that are ruled by rightist parties.

1. Introduction

Reliable and affordable access to electricity is important to the development process of any country [3,39,46]. Despite the importance of electrification, many emerging countries struggle to provide this basic good to their citizens. India, where 400 million people do not have access to electricity, is a classic example [26]. According to the literature, not all individuals are equally at risk of having to deal with poor electricity infrastructure [2,10,29]. In urban areas, electricity is much more readily available and its supply more reliable than in rural areas.

The rural-urban distinction may provide an incomplete picture of the electricity problem in India, as it underestimates the complexity of the situation caused by urban slums [47]. The Indian census defines slums as "residential areas where dwellings are unfit for human habitation by reasons of dilapidation, overcrowding, faulty arrangements and design of such buildings, narrowness or faulty arrangement of street, lack of ventilation, light, or sanitation facilities or any combination of these factors which are detrimental to the safety and health" [26].[1] Based on 2011 census data, slums hosted about 68 million Indians (over 5% of the total Indian population and 17% of the urban population), and the number was growing.[2]

As urbanization continues unabated in India, the number of slum dwellers is expected to continue to increase. In the absence of significant policies which would improve the living conditions in these areas, people will continue to live at risk of poor health, violence, and poverty [37]. In particular, improving access to energy and electricity is critical for development [25,41]. This article sheds some light on the challenges faced by policymakers in the electrification of slums by contrasting their plight with the situation in

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[1] In preparatory work for the 2011 census, a slum was defined in more detail as a "cluster of hutments with dilapidated and infirm structures having common or no toilet facilities, suffering from lack of basic amenities, inadequate arrangement for drainage and for disposal of solid wastes and garbage. These inadequacies make the living conditions in slums extremely suboptimal, unhygienic and result in usually higher incidence of air and water borne diseases for the dwellers," *Census of India 2011 – Circular No. 8*, censusindia.gov.in/2011-Circulars/Circulars/Circular-08.pdf (accessed June 1, 2013).

[2] "68 million Indians Living in Slums", *Times of India*, March 21, 2013.

rural and planned urban areas. To this end, we draw on survey data from the 2004–2005 Indian Human Development Survey [18]. This large survey has data on the livelihoods and socio-economic conditions of more than 40,000 households from all states of India. The data clearly indicate whether or not the household lives in rural, urban, or slum areas. The survey questionnaire also contains detailed questions about electricity access and use. These data, collected a few years ago, are still highly relevant to understand Indian slums. Slums have continued to grow at a rapid pace. Based on data from the 2001 and 2011 censuses, we know that the slum population has increased by more than 10 million people to about 68 million individuals. Furthermore, while electrification has improved in urban settings (which include slums), going from 88 to 93%, this still leaves millions of people without a reliable access to electricity. Thus, the problem remains a major policy issue.

The goals of this article are threefold. First, we quantify the extent of slum electrification, both in terms of availability and reliability of supply, with explicit comparisons to rural and other urban areas. Second, we develop a statistical model of slum electrification to distinguish between the significance of the slum location and other factors, such as low household incomes. Finally, we shed light on the causes of variation in slum electrification by investigating the role of various political and institutional factors at the state level.

Our three goals are motivated by important gaps in the body of literature on electricity in developing countries. There is a large body of literature on energy access in rural areas, showing that the lack of modern energy services is a major obstacle to economic development [6,8,9]. While the stark reality is that developing countries are urbanizing faster than ever [13,36], the literature on urban electrification problems in India and elsewhere is limited in scope. To the extent that urban electricity is considered at all, most studies [4,11,16,19,40] do not distinguish clearly between slums and planned areas. One of our contributions is to make a clear distinction between these two areas, highlighting considerable variation between these two types of urban settlements and calling into question some previous findings concerning the high quality of electricity supply in urban areas. Our econometric methods are similar to those in existing studies, but our sample is much larger.

Available studies on slums in particular usually focus on limited geographic areas. Using data from a handful of Gujarati slums, Parikh, Chaturvedi, and George [42] show that electricity is considered a basic priority service among slum dwellers. We shed light on the extent of electricity access in Indian slums across the country, also providing an explanation for variation across states. Baruah [5] finds that non-governmental organizations in the city of Ahmedabad have allowed slum dwellers to gain access to improved electricity services through cooperation with electric utilities and municipalities. Schaengold [45] documents the degree of electricity access in Mumbai slums and illuminates the causes of problems. These include the difficulty of payment collections, the lack of legal status of property, and poverty. He also considers the possibility of distributed, off-grid electrification for slums. Through survey research in Mumbai, Mimmi [34] shows that affordability, lack of house ownership and legal title, the low quality of housing, and the complexity of community relations in slums are obstacles to regular electricity supply. Lipu, Jamal, and Miah [33] report similar findings from Bangladesh, adding that the city of Dhaka lacks a specific energy policy for slums.

Our study provides a more detailed and representative analysis of slum electrification across all of India, precisely quantifying needs and benefiting electrification efforts by identifying priority areas. We go beyond the typical focus of slum studies, that is, metropolitan agglomerations with population in the millions. Using nationally representative data on India, ours is the first comprehensive study that considers slums in smaller cities as well. In doing so, we show that the problem of slum electrification reaches well beyond the typical metropolitan areas that others have studied, such as Mumbai. Finally, we describe and provide a political-economic explanation for variation in slum electrification across Indian states. Our study is the first to use nationally representative data to provide such an explanation across Indian states.

We begin by providing a summary of the electricity situation in slums. We then scrutinize the data in greater detail by estimating various econometric models. Third, we provide preliminary evidence for explaining the situation in urban slums. Finally, we discuss the implications of our findings.

2. Electrification and power supply in Indian slums

We now characterize the electricity situation in India. Specifically, we compare and contrast the conditions faced by households located in slums with either planned urban or rural areas. While the situation in urban and rural areas has been studied elsewhere [2], little is known about slums. We show that urban slums fall somewhere between the two other types of areas. This is important, given that about 70 million Indians already live in urban slums, as discussed in the introduction, and that number is growing. Although the central government in New Delhi has emphasized the importance of turning slums into planned urban areas with proper infrastructure and amenities, in practice the current policies and schemes suffer from several weaknesses and are making at best slow progress [32].

2.1. Data on electricity in rural, urban, and slum areas

We draw on data from the IHDS (India Human Development Survey), which was administered to over 40,000 households across India [18]. The survey was conducted in 2004–2005 and covers a broad range of questions. Importantly, the survey is representative of the broader Indian population once the appropriate weighting scheme is used. Since the IHDS combines samples conducted in rural and in urban areas, IHDS provides weights on each observation (respondent) to make the combined survey representative of the population.

The data have several advantages over typical alternatives. Although the 2011 Census of India would provide an overview of basic electricity access, the raw household data are not available for researchers. Moreover, the census data do not provide details of electricity payments or daily hours of access. In this regard, the IHDS data are much more precise. The other standard alternative is the NSS (National Sample Survey) dataset. Conducted every five years, this major survey collects detailed data on household expenditures. However, the NSS data do not distinguish between slums and planned urban areas. Moreover, there is no information on hours of electricity access. Again, the details of the IHDS dataset make it uniquely suitable for our analysis.

We focus on two variables of interest. First, we examine if households have electricity. The question given is “Does this house have electricity?” and the answer is coded 1 if the household has electricity and 0 if not. Overall, we find that 72% of all households in the sample have electricity, though this number varies considerably by location, as we document below.

Second, beyond having electricity, the reliability of electricity is particularly important. While many households are officially deemed to be connected to the electricity grid, India regularly suffers from massive blackouts. Hence, we also examine the number of hours per day during which electricity is available. The question is “How many hours per day do you generally have power?” and measured in numbers of hours. The sample average is almost 16 h, with a standard deviation of 7.