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Communication

Electoral cycles in electricity losses in India

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HIGHLIGHTS

- A third of electricity in India is lost each year.
- Electricity losses increase by 3 percentage points in periods leading up to statewide elections in India's largest state.
- Candidates are more likely to win re-election in areas where line losses are allowed to increase.
- Political factors affect line losses in ways that technical and economic factors alone cannot explain.

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ABSTRACT

A third of electricity in India is lost each year, where losses refer to power that is supplied but not billed. Utilizing data from the power corporation of Uttar Pradesh, India's most populous state, we study the politics of electricity losses. Examining annual data over four decades, we document that UP's electricity losses tend to increase in periods immediately prior to state assembly elections. Drawing upon geographically disaggregated data for the period 2000–09, we observe higher line losses just prior to the 2002 and 2007 state elections. Our analysis shows that the incumbent party was more likely to retain the assembly seat as line losses in the locality increased. We interpret these results as corroboration that political parties deliberately redirect electricity to flat rate and unbilled users in a context of chronically inadequate supply. Political factors appear to affect line losses in ways that technical and economic factors alone cannot explain.

1. Introduction

In many developing countries, electricity theft and line losses are a costly burden on the power sector (Depuru et al., 2011). Transmission and distribution (T&D) losses are estimated to cost India's economy 1.5% of GDP each year, aggravating chronic power shortages and straining the precarious finances of its public electricity providers (Bhatia and Gulati, 2004). In India's largest state, Uttar Pradesh, 29% of all power sent out from 1970 to 2010 was never billed for, presumably lost to theft, billing irregularities, and technical losses. This cumulative loss amounts to some 300 million megawatt-hours (MWh), enough to power all of Italy or South Africa for a year. Moreover, rates of line loss in Uttar Pradesh are higher today than they were in the 1970s despite numerous policy interventions, regulatory reforms, and increased efforts to prosecute power theft.

We examine data from Uttar Pradesh to demonstrate that variations in electricity losses are related to the timing of statewide elections. The focus of our study is on line losses — electricity that is received by power substations for distribution to end consumers but for which bills are not issued. Some of these losses are technical in nature, including resistive losses from high voltage transmission and variations in the quality of electrical infrastructure.[2] The remaining (majority) line losses are widely assumed to reflect inefficiencies in billing, meter tampering, illegal connections, and use by flat rate consumers that exceeds their nominal allotments. Yet such explanations do not fully explain why rates of line loss vary over time within the same geographic unit. We present evidence that the cyclicality of losses are consistent with patterns of political manipulation of the power sector associated with election periods. Given the scarcity of electrical power, its value to consumers, and the central role of politicians and public officials in its provision, electricity is a potentially valuable weapon in electoral competition.

We report on statewide trends from 1970 to 2010 and then examine within-state disaggregated data on electrical power distribution, billing, and line losses from 2000 to 2009. The main results

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[2] Such technical losses range from 1–2 percent in efficient systems to as high as 9–12 percent in less efficient systems, according to Smith (2004, p. 2070). Line losses in India are much larger than this, on the order of 30 percent.

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of our analysis are as follows. First, the data show that line losses in Uttar Pradesh are substantively very large in magnitude. Second, line losses are substantially higher in periods immediately prior to state elections. Third, extending this line of argument, we document that the incumbent political party is more likely to retain the state assembly seat where line loss is more extensive. We interpret these results as corroboration of the theory that electricity distribution is manipulated for political gain. Our results suggest that a part of line losses can be explained by political motivations rather than only by technical and economic factors.

Our paper is related to studies of the political business cycle in subnational units (examples include Baleiras and Costa, 2004; Drazen and Eslava, 2005; Mouriuen, 2007), which grew out of studies of the political business cycle at the national level (Nordhaus, 1975; Tufte, 1980). Various papers show that municipal level elected officials manipulate aspects of the local political economy prior to elections in order to improve their chances of reelection. Of particular relevance is Khemani (2004), which documents state-level electorally sensitive targeting of advantage to special interests in India. Another paper especially related to this one Badiani and Jessoe (2011) shows that agricultural price subsidies for electricity increase significantly in the year prior to an election in India.

A large literature on political corruption is also relevant (Rose-Ackerman, 1999; Johnston, 2006; Treisman, 2007), particularly studies showing that corruption rates are correlated with the reelection incentives of politicians (Ferraz, 2006). The only studies of which we are aware that study energy theft as a problem of corruption are Smith (2004) and Joseph (2010). The first is a cross-national study of T&D losses in electricity transmission linking it to corruption as well as weaknesses in accountability and institutional performance. The second reports that T&D losses across Indian states are associated with decisions by firms to establish their own power-generating capacity, exiting the state provider.

Finally, our study draws on a large literature on the politics of public goods provision and a small literature specifically on the political economy of electricity provision. The former is exceedingly vast; for a review, see Golden and Min (2013). A main result of the distributive politics literature is to underscore that public officials use electoral criteria in the allocation of government goods and services rather than utilizing strictly welfare maximizing criteria. There is considerable national and local variation in how this occurs, however, in part because features of electoral competition differ. As regards electricity provision, Brown and Mobarak (2009) shows that in poorer countries, democratic political institutions shift electricity provision from the industrial sector to households, whereas authoritarian institutions favor industry. Min (2010) documents partisan effects in electricity provision in Uttar Pradesh. Other studies, including Bernard et al. (1997), show that electricity prices may be politically manipulated for electoral ends, in line with the general distributive politics theme.

2. Electricity in Uttar Pradesh

Uttar Pradesh is India's largest state, with a population of 190 million people in an area about half the size of California. According to World Bank estimates, it is home to 8 percent of the world's poor. Electricity transmission and distribution in Uttar Pradesh is the responsibility of the state-owned and -managed Uttar Pradesh Power Corporation Ltd (UPPCL), formed in 2000 as a result of power sector reforms to India's state electricity boards. Workers at UPPCL are state employees and its key leadership positions are filled by appointments made by the state government. Electricity provision is a state-level responsibility in India's federal structure and the central government plays little role in how electricity is distributed within the individual states.

Electricity provision in Uttar Pradesh is characterized by a severe shortage of supply relative to demand. Total generation capacity in the state barely changed from 4.4 GW in 2002 to 4.7 GW in 2012. Meanwhile, peak demand soared from 7.4 GW to 11.8 GW over the same period due to population growth and economic development (UPPCL, 2012). Some of the supply shortfall has been made up via power imports from out of state. The remaining gap results in continual load shedding – rolling outages lasting several hours a day across most of the state. Villages are supposed to receive 10 h of power per day, though actual provision varies widely.[3] The incidence and frequency of power cuts is widely assumed to be susceptible to political distortions.

Farmers, especially the wealthier owners of electric pumps used for irrigation, have long benefited from favorable power sector policies. Sumir Lal of the World Bank describes, "The tendency to tinker with power tariffs to buy popularity with the rich farming class began in the 1970s. Thereafter, such tinkering became a nation-wide contagion, and ruling parties have found that subsidizing agricultural inputs, and thus gaining big-farmer support, to be easier than developing long-term agrarian investment and growth strategies" (Lal, 2006, p. 9). Metering of rural households and agricultural users in Uttar Pradesh was eliminated in the mid-1970s and replaced by low flat rates, a policy that has been adopted by many states across India (Shah, 2000). In 2012, a farmer with a one horsepower electric tubewell was paying only 75 Rupees (about $US 1.50) per month for electricity.

Since rural users pay flat rates for power, rural electricity consumption is largely determined by how much supply is provided from substations in the form of hours of power per day. Meanwhile billing in rural areas is largely insensitive to variations in consumption since most users pay fixed fees. By contrast, in urban areas, where usage is metered, consumption and revenues should be positively correlated.

Our primary outcome variable is line losses, measured as the share of electrical power that is distributed from the power substation busbar but for which bills are not issued.[4] Line losses are thus a function of the total amount of power distributed to consumers and the total amount of billing sent out to consumers, activities that we postulate are subject to distortions during politically critical periods.

Line losses are not the only factor implicated in the financial distress of Uttar Pradesh's power corporation. Even when bills are sent to customers, many go unpaid, aggravating the power corporation's revenue shortfalls. In India, the combination of technical and financial losses are referred to as aggregate technical and commercial (AT&C) losses. While political factors may also be correlated with variations in the efficiency of bill collection, this study focuses only on technical line losses, which have not previously been linked to election cycles.

We examine annual data in statewide losses from 1970 to 2010 and compare these to the timing of state assembly elections, ten of which were held during this time period. For the recent period (2000 to 2009), we acquired more finely disaggregated data from the UPPCL at the level of the service division, the smallest geographic unit for which it reports line losses.[5] UPPCL divided the state of Uttar Pradesh into 193 divisions at the end of 2009. When the

[3] "UP Power Corporation Limited to give 10 h uninterrupted power supply to villages," *Times of India*, 18 November 2012.

[4] As defined by UPPCL, Line Loss = (Energy Received at the Substation in GWh -Energy Sold and Billed For in GWh)/Energy Received at the Substation in GWh $\times$ 100.

[5] UPPCL divisions are nested within larger circles, which are in turn nested within larger zones.