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The determinants of electricity theft: An empirical analysis of Indian states

Vasundhara Gaur, Eshita Gupta *

Department of Policy Studies, TERI University, India

HIGHLIGHTS

- Over 20% of total electricity generated in India is lost to thefts.
- The study attempts to identify the determinants of electricity theft in India.
- Use of panel data from 2005 to 2009 for 28 Indian states.
- FGLS and OLS regression results are compared.
- The determinants of power theft are both governmental and socio-economic in nature.

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ABSTRACT

More than 20% of the electricity generated in India is lost to rampant thefts. Drawing data from 28 states of India over a time span of five years (2005–2009), this paper examines the role played by socio-economic and governance factors in determining the extent of electricity thefts in Indian states. Results from the Feasible Generalised Least Squares (FGLS) model demonstrate that lesser corruption, higher state tax to GDP ratio, greater collection efficiency of electricity bills by state utilities, higher share of private installed capacity, lesser poverty, greater literacy and greater income are closely associated with lesser power thefts. A better understanding of the key determinants of thefts in electricity distribution is vital for policy makers for designing policies.

1. Introduction

India's demand for electricity is growing fast and the supply is unable to keep pace with the growth in demand resulting in the demand–supply gap of 3.6% in 2014–15 (Load Generation Balance Report, 2015–16). On July 31st, 2012, India experienced the largest power outage in the history (so far), when the entire northern grid collapsed and plunged most of north India in darkness, affecting around 700 million people. Why does India have these massive power shortages? It is increasingly being recognised by academicians and practitioners that the lack of domestic resources, poor infrastructure and poor governance are the key factors responsible for the continued problem. More than 30% of total electricity generated in India is lost due to thefts and inefficiencies in transmission and distribution (Sekhar, 2014). A better understanding of the key determinants of thefts in electricity distribution is vital for policy makers to address the challenge of reducing the size of the existing power shortages.

Electricity can be stolen through several techniques. In India, it is not uncommon to find consumers drawing electricity by hooking a wire to utility poles. Since the wire is not connected to a metre and the consumption is unrecorded, this constitutes to theft. Even when electricity metres are in place, consumers often commit fraud and tamper with them using magnets to show consumption being less than it would be otherwise. Finally, consumers either default completely on their bills or bribe the utility employees to record the metre at a lower value than it shows, both of which lead to billing irregularities the ultimate effect of which is power thefts. (Smith, 2004; Depuru et al., 2011)

Several studies analysing the relationship between electricity theft and its determinants have used transmission and distribution (T&D) losses as an indicator of power thefts for a given economy (Smith, 2004; Min and Golden, 2014). The T&D losses have two components: technical losses and commercial (or non-technical) losses. The technical component comprises of inevitable losses due to energy dissipation when electricity is transmitted across long distances but they are intrinsic to the system and can be brought

* Corresponding author.
E-mail addresses: vasundharagaur@gmail.com (V. Gaur), egupta13@gmail.com (E. Gupta).

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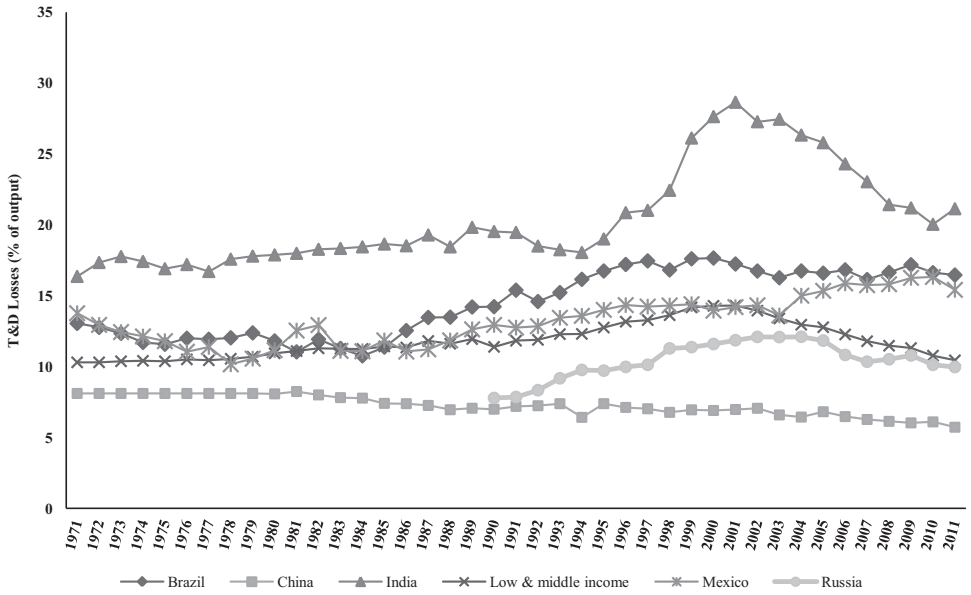

Fig. 1. T&D loss comparison across other nations (World Development Indicators, World Bank, 2014).

down to optimal levels. However, it is the component of commercial losses (including electricity theft through pilferage and other fraudulent practices) that constitutes a major part of the total T&D losses and which goes unaccounted for (Smith, 2004).

Unlike in developed economies, where the technical losses range between 2% and 4% of the total electricity output, in developing countries these losses can reach up to as high as 10–12% (Smith, 2004). However, developing countries report T&D losses to be far higher than this figure. In India itself, even if we assume the supply system to be of the least efficient kind, the average T&D losses are almost two times than that, implying that 20% of these losses are on account of power thefts. As can be seen from Fig. 1, even when compared to other low and middle income countries, India's T&D losses have historically been very high.

For the year 2009, the state-wise aggregate T&D losses and profits (as a percentage of revenue) of power utilities are displayed in Fig. 2. While the all India aggregate T&D losses are 32.23%, there are states with T&D losses as high as twice that amount. It is clearly visible that the states with the highest T&D losses (specifically Bihar, Arunachal Pradesh, Mizoram, Jammu and Kashmir, Nagaland and Manipur) are also the ones whose power utilities are under the most financial turmoil with the lowest profits (highest losses). When consumers steal electricity, they are in effect drawing more than the allocated power which causes an overload at the generation unit. This causes the electricity supply to not only be sporadic but also fraught with frequent voltage fluctuations. The distribution companies (DISCOMs), unable to generate enough revenues as a result of this theft, face financial imbalances, which further reduces their capability to invest in better infrastructure and manpower to check pilferage. Thus begins the vicious theft-loss spiral. According to a study by World Bank, power theft reduces India's Gross Domestic Product (GDP) by around 1.5% (Bhatia and Gulati, 2004). Kochhar et al. (2006) also found a strong, negative association existing between the economic growth of Indian states and their respective power sector's transmission and distribution losses.

The primary query of this paper centres on the role played by different factors in determining the extent of electricity thefts in Indian states. There have been a few empirical studies to identify the key determinants and evaluate their impact on electricity thefts. A significant part of the literature points out that poor governance factors are the key determinants of power thefts in addition to socio-economic factors (Min and Golden, 2014; Smith 2004; Steadman, 2011). In an attempt to find a relation between populism and power theft, Min and Golden (2014) undertook a study in the state of Uttar Pradesh in India and found a concrete relation between electricity theft and electoral cycles by demonstrating how theft rates increased just prior to a new election term.

This paper contributes to the existing literature significantly. This is the first study on power thefts that has been conducted at the all-India level. The underlying motivation of the study stems from the fact that there exists a considerable variation among the states in terms of electricity thefts. The degree to which this discrepancy is explained by the differences in socio-economic and governance indicators of the states needs to be explored. One would envisage that as socio-economic and governance factors improve the extent of electricity thefts decrease. How far this phenomenon is reflected in the Indian scenario needs to be empirically tested. Results from the Feasible Generalized Least Squares (FGLS) model demonstrate that lesser corruption, higher state tax to GDP ratio, greater collection efficiency of electricity bills by state utilities, higher share of private installed capacity, lesser poverty, greater literacy and greater income are closely associated with lesser power thefts. These results are also compared with the estimates obtained from an OLS cluster-robust regression.

The next section is dedicated to the discussion of existing literature and the methodological approach taken to study the determinants of power thefts in India. The results of the same are analysed in depth in the third section. The fourth and final section summarizes these findings and concludes with policy recommendations that may play a role in tackling this issue.

2. What factors determine power thefts?

There has been a considerable amount of research examining the relationship been electricity thefts and its key determinants. Studies have found corruption to be a crucial determinant of power theft in developing countries like India and Pakistan (Jamil and Ahmad, 2013; Katiyar, 2013). Furthermore, poor governance was linked to corruption through political instability, lack of accountability and bribery (Smith, 2004; Steadman, 2011). Similarly, good governance was associated to a state's enforcement capacity