



Electricity theft among residential consumers in Rawalpindi and Islamabad

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ABSTRACT

Pakistan faces the perennial issue of electricity theft. The issue deteriorates the financial outlook of utilities and is detrimental to investment in capacity improvement of electricity grid. The solution is generally sought through fiscal injection in capacity enhancement, demand-side management and rationing of electricity. This study investigates the key factors that contributes in electricity theft through structured questionnaires from residential electricity consumers of IESCO in the twin cities of Rawalpindi and Islamabad. A sample size comprise of both rural and urban respondents. The demographic profile and descriptive statistics are discussed. Most of the respondents agree that electricity price hike is the main contributor in rising theft. The crime is taking place with the connivance of bribe accepting utility employees. The correlation analysis is carried out and the data is further used for the empirical estimation of the model. The regression analysis employed key variables such as the conduct of utility employee, consumers' satisfaction with the service, monitoring, overall consumer perception and the monthly expenses on electricity consumption. The results suggest that monitoring, conduct and monthly expenses variables are significant in explaining electricity theft. These finding suggest an increase in transparency and accountability and a decrease in tariffs to reduce pilferage.

1. . Introduction

Electricity is essential for a modern economy and most of the production and consumption activities require its uninterrupted supply. Electricity consumption data in Pakistan shows an ever-increasing trends. There might be electricity shortfall in the presence of widespread non-technical losses and electricity theft. As a result, electric utilities face financial problems that halt the investment in capacity upgradation (Jamil and Ahmad, 2011; Kessides, 2013; Khan et al., 2016; Arshad and Ali, 2017). Prevalence of petty corruption adds to electricity theft that comprises of the cases in which electricity is stolen with the connivance of utility employees. When an electricity distribution company fails to recover its cost due to improper recording and reporting of electricity consumed or non-payment of bills, it makes the power supply unsustainable (Jamil and Ahmad, 2013). Electrical energy is stolen worldwide and the costs are routinely transferred to the paying consumers as they have to face high tariff rates along with poor quality of supply (Smith, 2004; Depuru et al., 2011; Kessides, 2013; Arshad and Ali, 2017).

The anatomy of electricity theft can be explained as follows. A dishonest consumer either steals electricity directly from distribution lines or colludes with a utility employee in order to reduce the risk of detection and conviction. Poorly designed regulations and weak governance of the utilities may induce some consumers to get illicit

benefits. Thus, the electricity consumers may become the suppliers of bribe thus making detection of electricity theft difficult.

The policy prescription based on the earlier studies focus only on the supply-side and presumes the consumer behavior as given. Literature is quite scarce on the socioeconomic, political and governance factors that may cause electricity theft. So without going into details of the issue and its various forms and methods from the viewpoint of electricity supplier, we primarily focus on examining the issue from a consumer perspective. Our approach is to study the role of consumers' perception regarding the prospects and viability of electricity theft. For this sake, we surveyed the individual residents of Rawalpindi and Islamabad covering both the rural and urban areas. The study obtains data from consumers about their perception regarding the prevalence and causes of electricity theft. The responses of the consumers are important for the analysis because consumers constitute both the culprits and victims of the crime.

The field survey used a structured questionnaire that covers the consumer's perception and knowledge about key variables including the extent of electricity theft, their satisfaction from the service provision and conduct of the utility employees. The results show that respondents' perception of being detected and their monthly expenses on the purchase of electricity contribute positively to electricity theft whereas, monitoring and conduct of utility employees are found negatively affecting the extent of theft. The findings reiterate the

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importance of improved governance in electric utilities.

Rest of the study is organized as follows. We begin by looking at the relationship between crimes and law enforcement in Section 3 and find through review of literature how corruption creeps into system. Section 4 illustrates the extent of electricity theft in Pakistan. We then proceed to the model specification and survey design in Section 5. The final section summarizes the findings and concludes the study.

2. Relationship between crime control and corruption

Electricity theft is a crime that involves sanctions on detection. The literature on economics of crimes covers law enforcement, sanctions and deterrence, and corruption. Becker (1968) is the seminal paper on the topic that motivates the contemporary research in the economics of crimes. It argues that an offender is a utility maximizing agent who weighs the subjective costs and benefits of the offence such that an offence will be committed if gain to the offender from offence exceeds the expected cost. The economic cost-benefit analysis aims to develop optimal public and private policies to combating crimes.

Economic and political factors are studied as key determinants of criminal behavior alongside the technological aspects. Golden and Min (2012) study the politics of electricity theft in an Indian state and show that the extent of electricity theft moves with the electoral cycle of the state. During the election years, electricity theft increases significantly with rising intensity of tube wells, which suggest that it is linked to unmetered electricity use by the farmers. The chances of winning the election for the incumbent members of the state assembly increase if they tolerate an increased electricity theft in their locality. The study therefore, concludes that electricity theft may show characteristics consistent with the political capture of public service delivery.

Economics literature suggests that electricity theft stems mainly from three sources: socioeconomic factors, technological deficiencies and institutional irregularities. There are numerous studies on political and bureaucratic corruption and its consequences in different sectors of the economy. Electricity theft and corruption are illegal and combating these crimes is difficult as the monitors are frequently facilitating the crime. Xin and Rudel (2004) employ the principal agent model and show that an individual's perception is crucial in determining behavior towards electricity pilferage and corruption. The motivating factors may include monetary benefits as well as various other factors influencing the behavior of the offenders. Some studies identify the factors other than the pecuniary benefits and costs involved in decision to indulge in criminal activity such as moral, psychological and reputational aspects (Gordon, 1989; Myles and Naylor, 1996; Tirole, 1996).

Various studies survey in detail the literature on corruption covering multidimensional aspects of corruption and its determinants (see, for instance, Jain, 2001; Aidt, 2003; and Silva et al., 2007). Most of the studies identify corruption as socially and economically undesirable (see, for example, Shleifer and Vishny, 1993; Groenendijk, 1997; Polinsky and Shavell, 2001; and, Jain, 2001; Clarke and Xu, 2004). Shleifer and Vishny (1993) termed the corruptible employee as a monopolist who sells the good to maximize the value of his illegal payoffs. Polinsky and Shavell (2001) illustrates that corruption dilutes deterrence imposed by the penalties hence it should be reduced. Institutional factors, law enforcement and individual characteristics in economics of crimes is highlighted with a view to obtain optimal deterrence through law and morality. An individual's perceptions regarding his decision of stealing electricity may be influenced by the realities that he and others have faced in the past. These perceptions determine their current and future actions and ultimately affect the expected consequences. In different regions, the corruption perception of individuals regarding illegal activities may vary and hence their chances of indulging in such activities may also change (Sah, 2005).

There are a few contemporary studies on the topic of corruption and electricity theft from the utilities' perspective (for example, Smith, 2004; Estache et al., 2006; Singh, 2006; Bó and Rossi, 2007; Nakano

and Managi, 2008; Nagayama, 2010; and, Jamil and Ahmad, 2014). Nagayama (2010) examine the impact of power-sector reforms on certain indicators of performance such as, installed capacity, transmission and distribution losses of utilities and finds that reforms like utilities' unbundling, establishing regulators and wholesale spot electricity market has resulted in increased generation capacity as well as reduced transmission and distribution loss in the respective regions. Some studies find poor governance, inefficiency and lack of competition as the major causes of electricity theft (see for example, Pacudan and Guzman, 2002; Nagayama, 2010). Institutional disharmony, politicization, and corruption render the task of public management difficult and the establishment of good governance unattainable.

Past studies predominantly use secondary data at aggregate levels to find the impact of different factors in determining the level of electricity theft (see for example, Bò and Rossi, 2007; Jamil and Ahmad, 2014). The social and economic characteristics of the individuals and their decision making is generally overlooked. Electricity distribution system will not function when many consumers steal electricity. In this backdrop, we focus on examining the consumers' behavior towards electricity theft by obtaining primary data on their perception where a stealing consumer is an offender and the decision of the offence depends on the perceived net benefit from the crime. We undertake a comprehensive analysis of qualitative and quantitative data where all forward and backward linkages of electricity theft are considered.

3. Structure of electricity theft and theoretical linkages

It is pertinent at the outset to understand the composition of the distribution system in order to better understand the structure of electricity theft and corruption. Electricity is generated at various power stations that are generally located away from the load centers. Electric power is then transmitted to end-users through a transmission and distribution (T&D) system comprising of grid, transformers and wires. When electricity passes through a wire, some of the energy is lost due to the resistance. These losses are generally termed T & D losses in an electricity system. The electricity losses in transmission lines of 132 kV and 11 kV are considered as transmission losses whereas, the losses in some 11 kV and 440 V lines are called distribution losses. The distribution losses comprise of technical and non-technical components and electricity theft is the major part of non-technical losses.

Smith (2004) define electricity theft as any form of fraud (meter tampering), pilferage (illegal abstraction), billing irregularities (corruption) and unpaid bills. In particular, any illegal diversion of electricity from main line or any illegal act to avoid paying for electricity by violating the laws can be termed as theft. Nepal and Jamasb (2002) show that non-technical electricity losses due to electricity theft is widespread across residential areas in the South Asia where households either do not have the ability or willingness to pay for electricity usage.

Electricity supply can be bifurcated into generation, transmission and distribution. Distribution network is generally lying on-ground and the chances exist for consumers to illegally abstract electricity either through by-passing or tempering the meter. Any illegal abstraction from the grid is a criminal act subject to penalty as per Electricity Act. Electricity distribution is administered in Pakistan through 9 companies that have exclusive rights to supply electricity in its jurisdiction. The country is following single buyer model where Central Power Purchasing Agency (CPPA) purchase electricity from various generators and allocate it to these distribution companies. Distribution companies operate in the four provinces, FATA and in the capital territory. The implementation of penal system for the defaulters or criminals is the responsibility of the police department of the respective province. Rule of law requires that the regulations and administrative provisions are enforced effectively and jointly by different tiers and agencies of the government. The problem may arise when a provincial government may choose to not help the distribution company in recovering the dues and enforcement of the rule of law since the loss would be borne by the

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