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On the electricity shortage, price and electricity theft nexus

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HIGHLIGHTS

- ▶ The study investigates relationship among electricity outages, price and electricity theft.
- ▶ It employed Johansen approach, ECM and variance decomposition analysis.
- ▶ Empirical evidence shows that electricity theft causes outages and rising tariff rates.
- ▶ Variance decomposition analysis results are slightly different from ECM.

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ABSTRACT

Pakistan is facing severe electricity shortfall of its history since 2006. Several measures have been implemented in order to mitigate electricity shortage. The focus has been on raising the installed capacity of electricity generation and transmission. The present policy results in expensive thermal electricity generation mostly using expensive and environmentally hazardous furnace oil and inability of utilities to recover their cost of supply although there is unprecedented rise in electricity tariffs. This study concentrates on the electricity demand and traces the relationship between electricity shortfalls, tariff rate and electricity theft in the background of recent electricity crisis using the data for the period 1985–2010. We employed the Granger causality test through error correction model and out-of-sample causality through variance decomposition method. Empirical evidence shows that electricity theft greatly influences electricity shortfalls through lowering investment and inefficient use of electricity.

The study concludes that electricity crisis cannot be handled without combating rampant electricity theft in the country.

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1. Introduction

Energy is an essential input in production models along with capital, labor and technology and its sustainable supply at affordable prices is inevitable for a modern economy. It is therefore, a perennial constraint to output growth. The electricity sectors of developing countries are characterized with poor quality of electricity supply service and frequent outages. Electricity shortfall impedes economic growth and production, causes unemployment, and raises the cost of production and doing businesses. Various studies identify the relationship between electricity consumption and economic activity either through a demand-side model (for example, Asafu-Adjaye, 2000; Siddiqui, 2004; Jamil and Ahmad, 2010) or a supply-side model (see, for example, Ghali and El-Sakka, 2004; Shahbaz and Lean, 2012). In a recent survey of empirical literature tracing hypotheses regarding the relationship between electricity consumption and economic growth in world economies, Payne (2010) finds

that only 31% cases support the neutrality hypothesis of electricity consumption with the economic growth whereas, 28% cases support the electricity conservation hypothesis; 23% the growth driven electricity consumption hypothesis; and 18% the bi-directional causality.

Many contemporary studies investigate the causal relationship between electricity consumption and output in Pakistan and found that economic growth is not neutral to electricity consumption (for example, Siddiqui, 2004; Jamil and Ahmad, 2011; Shahbaz and Lean, 2012). Electricity shortage hurts all sectors though degree may vary. Some studies estimate the loss of industrial output caused by electricity shortfall or load shedding in Pakistan and finds that annual production loss amounts to over a billion dollar only in industrial sector (Pasha et al., 1989; Pasha et al., 1990; IPP, 2009; Siddiqui et al., 2011).

For sustainable and affordable supply of electricity, regular expansion of cost effective and diversified electricity generation infrastructure is required. Otherwise, the energy prices will rise to levels that people find it hard to pay for it and production sectors become uncompetitive. Higher prices increase the consumers' temptation to steal electricity as the net payoffs tend to be higher.

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Electric power worth billions of dollars is stolen every year worldwide. Electricity theft alone costs hundreds of million dollars every year to electricity distribution companies in Pakistan (Bhatia and Gulati, 2004; Smith, 2004; Jamil, 2012). Electricity theft can be traced back to factors linked to the utility governance and wider socio-economic environment (see for example, Clarke and Xu, 2004; Katiyar, 2005; Bò and Rossi, 2007; Jamil, 2012). However, this study focus the analysis to identifying relationship between tariff rate, electricity outages and electricity theft.

There are nine electricity distribution companies operating in Pakistan out of which eight are public monopolies responsible to deliver electricity in their areas of operation including, Islamabad Electricity Supply Company (IESCO), Lahore Electricity Supply Company (LESCO), Gujranwala Electric Power Company (GEPSCO), Faisalabad Electricity Supply Company (FESCO), Multan Electric Power Company (MEPCO), Peshawar Electricity Supply Company (PESCO), Quetta Electricity Supply Company (QESCO), and Hyderabad Electricity Supply Company (HESCO). Only Karachi Electric Supply Company (KESC) is in private sector, which is a vertically integrated company. The regulatory body National Electric Power Regulatory Authority (NEPRA) determines tariff rate for generation companies as well as consumers. Since electricity industry is predominantly under government control, the consumer tariffs are set keeping in view the political considerations of the government. The revenue recovered per unit of electricity supplied differs greatly among these distribution companies in the country mainly due to extent of electricity theft. Therefore, to meet its financial requirements the sector heavily relies on subsidies. Keeping in view the fiscal constraints, the delay in subsidy payments make it hard for the distribution companies to pay for electricity purchases and those in turn, cannot pay to input fuel suppliers hence, results in cash flow failure or circular debt. Electricity theft is the single most important barrier to the private investment in the power sector. Lack of investment affects the availability of capacity and making electricity generation lower than peak demand. Thus, the utilities have to resort demand-side management to shed the excess load. Load shedding is very costly for the production sectors of the economy (Pasha et al., 1989; Auffhammer et al., 2008). To ameliorate electricity supply situation, expensive future contracts of electricity generation are made, for example, rental power plants. It overburdens the public funds and putting pressures on future electricity tariff rates.

Pakistan is now pursuing long deferred reforms agenda of making the distribution companies autonomous and introducing competition at distribution level. Electricity reforms generally carried out in many countries in the last decade with the intensions to liberalizing the electricity markets, raising competition and investment, and lowering tariff rates. The past experiences in many countries show that reforming power sectors is very complicated process and without investment conducive institutional and political structure, efficient reforms are not possible (see also, Malik, 2007; Cetin and Oguz, 2007; Nepal and Jamasb, 2011; Planning Commission, 2011). Thus the success of power sector reforms is essentially inter-dependent on reforms in other sectors of the economy. Moreover, it could hardly be possible to reap the benefits of reforms and competition in the presence of growing electricity shortfalls (see for example, Belyaev, 2011). The benefits of the competition in terms of reliable and sustainable power and reduced tariff rates can be materialized only if there is installed capacity fairly in excess of peak demand.

Electricity demand grows at 6.4 percent annually in Pakistan during 1970–2009, a rate which is likely to be maintained in the 2010s. Keeping in view the detrimental effects of the load shedding (approaching to 5500 MW in 2010), this study is primarily concerned

with the correspondence between electricity theft, electricity price and load shedding. We use country-level data of Pakistan for these variables obtained from WAPDA (2010) for the period 1985–2010 and employed error correction model (ECM) for testing causality. Our empirical results show that electricity theft greatly influenced electricity shortfalls through lowering investment and inefficient use of electricity. The paper is organized as follows. Section 2 outlines the conceptual and modeling framework. Empirical estimation and results are given at Section 3. Finally Section 4 concludes the findings.

2. Conceptual framework

The well functioning electricity system maintains supply matching real time demand, low power losses and theft and universal access of population to electricity at equitable tariffs. Electricity supply entails huge capital cost on developing infrastructure as well as operational cost of fuel and maintenance. Therefore, electricity system cannot sustain if consumers do not pay for the service. Electricity theft directly affects tariffs since revenue leakages make it hard for the utility to supply electricity on lower tariffs. Since electricity distribution companies purchase electricity from public as well as private power producers at a tariff determined by NEPRA. Public utilities have to reduce their electricity purchases to reduce the subsidies burden. The public utility cannot invest in capacity expansion when it is not recovering its cost of electricity supply, which eventually results in electricity shortfalls.

In view of rising cost of electricity generation both tariff rate and government subsidies per unit supplied increase resulting in a growing temptation among consumers to steal electricity and the distribution companies to resort outages. The long and unscheduled load shedding increase the consumer cost of electricity through replacement measures like installation of small generators and uninterruptible power supply (UPS). These replacement measures are highly inefficient that adds to overall cost of living. Thus the recent electricity shortfall in Pakistan is a governance issue rather than capacity deficit.

Jamil (2012) analyze the impact of domestic natural gas shortage on gas consuming sectors especially power and manufacturing sectors in Pakistan and finds that gas shortage affects power sector the most as evident from declining trend of gas for power sector in Fig. 1. As a result, the share of oil products in thermal electricity generation rises. During the period 2006–2011, oil share rises in thermal electricity generation from 29% to 55% while the share of natural gas declined from 71% to 45% (Pakistan Energy Yearbook, 2011). The reduced gas allocation to power sector in addition to low availability of hydro resources add to the cost of electricity generation in Pakistan. The gap between the cost of electricity generation and revenue from its sales has widened when huge electricity is stolen. These factors shape the problem of inter-corporate circular debt in the energy

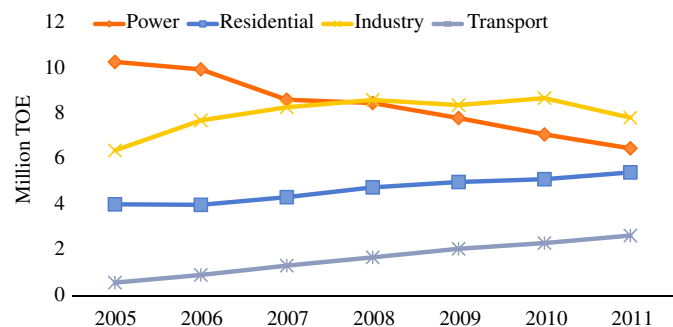


Fig. 1. Sector-wise natural gas consumption.

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