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Electricity consumption-economic growth Nexus: An aggregated and disaggregated causality analysis in India and Pakistan

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Abstract

This paper empirically examined the causality between electricity consumption and economic growth in two densely populated countries in South Asia, India and Pakistan. The causality analysis was estimated at aggregated and disaggregated level where the focus of the analysis was on the agricultural sector. The disaggregated causality analysis indicated a bi-directional causality between the agricultural electricity consumption and the agricultural GDP in India, while in Pakistan the causality was found to run from agricultural GDP to agricultural electricity consumption. At the aggregated level, India confirmed conservation hypothesis while Pakistan confirmed feedback hypothesis. From the public policy point of view, it can be inferred that, at the macro level, any electricity conservation measures in India will not have an affect on India's increasing economic growth prospects and hence a policy-favourite supply-enhancement strategy in the form of increasing electricity generation needs to be balanced with a demand-management strategy. In case of Pakistan any such policy recommendation is difficult given the bidirectional nature of causality.

JEL classification: Q43; Q48; Q10; C22; C52

Keywords: Electricity consumption; Agriculture growth; Causality; Error Correction Modelling; India; Pakistan

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1. Introduction

Growth process in an economy is energy intensive and hence the importance of energy (particularly electricity) in the growth process is universally accepted (Ferguson & Wilkinson, 2000; Stern & Cleveland, 2004). Electricity is an indispensable factor and plays an essential role in the consumption and production processes in an economy. India and Pakistan are the two large South Asian neighbours who have experienced high increase in electricity consumption and an increase in the gross domestic product (GDP) over the past four decades. This article aims to analyse the Nexus between the electricity consumption and economic growth in India and Pakistan. Whether there exist a causal relationship and in that case the direction of causality between electricity consumption and economic growth? This study undertook an aggregate level analysis and also disaggregated sectoral causality analysis[1] – the agricultural sector in both the countries – and in the process went beyond the usual practice of restricting the analysis to aggregate level. A disaggregated sectoral level causality analysis with a focus on agricultural sector has rarely been addressed in the voluminous electricity-economic growth literature, both at global level as well as in South Asia.

The empirical literature, as pointed out in Table 1, on electricity consumption and economic growth Nexus has not been able to infer conclusively the direction of causal relationship between electricity consumption and economic growth. There is no singular (directional) trend at a global level on whether electricity consumption causes economic growth or vice versa. The empirical literature on electricity consumption and economic growth at global level has shown all the four possible causal relationships: growth hypothesis, conservation hypothesis, neutrality hypothesis and feedback hypothesis (for details see: Payne, 2010)[2] to hold true for one country or other, with each of the hypothesis having their own policy significance.

Even for a single country, contrasting results was observed with changes in the time period of the data and/or econometric techniques used for the analysis[3] (Ozturk, 2010; Payne, 2010). For example, for Pakistan, the electricity consumption and the economic growth data for 1971–2003 concluded that economic growth causes the electricity consumption (Asghar, 2008), whereas for the period of 1955–1996 it was concluded that it was electricity consumption that was causing economic growth (Aqeel & Butt, 2001). In case of India, four out of five studies concluded that either electricity consumption had no causal relationship with economic growth or it is the economic growth that caused electricity consumption. But Gupta and Sahu (2009) argued that the electricity consumption causes economic growth.

The present study used the latest data series available for India and Pakistan, from 1972 to 2008, and in the process addressed some structural constraints pertaining to data on Pakistan used in other studies. While most of the studies concerning Pakistan has taken a time period prior to 1972, but the data-set prior to 1972 also included the data for Bangladesh (then East Pakistan), and thus is erroneous while drawing a policy inference for today's Pakistan. Such a conclusion was

[1] Bowden and Payne (2009) carried out a disaggregated analysis for USA energy and output causality. Their basic aim was to estimate the causal relation of use of energy in its various uses like transport, commercial, houses, etc.

[2] Growth hypothesis hold when electricity consumption causes economic growth (EC → EG); Conservation hypothesis hold when economic growth causes electricity consumption (EG → EC); Neutrality hypothesis hold when electricity consumption and economic growth do not cause each other even if they are correlated (EC × EG) and Feedback hypothesis hold when the causality is bidirectional that is both electricity consumption and economic growth are interdependent (EC ↔ EG).

[3] Most of the studies in Table 1 uses bivariate model, few also used multivariate models.