



Electricity consumption and economic growth: Evidence from Turkey

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Abstract

This study investigates the causal relationship between electricity consumption and real GDP in Turkey during the period of 1950–2000. Both of the series were found to be a stationary process around a structural break by the Zivot and Andrews test. Thus, two different methodologies have been employed to test the Granger non-causality: the Dolado–Lütkepohl test using the VARs in levels, and the standard Granger causality test using the detrended data. Both tests have yielded a strong evidence for unidirectional causality running from the electricity consumption to the income. This implies that the supply of electricity is vitally important to meet the growing electricity consumption, hence to sustain the economic growth in Turkey.

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1. Introduction

Although economic theories do not explicitly state a relationship between energy consumption and economic growth, empirical investigation of it has been one of the most attractive areas of energy economics literature for the recent two decades. Since the seminal work of Kraft and Kraft (1978), many studies have investigated the causal relationship between energy consumption and economic growth. In disaggregated level, electricity consumption

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especially, which is not only related to economic wealth but also an indicator of socioeconomic development, has been of another interest. For instance, [Ferguson et al. \(2000\)](#) analyzed the correlations between electricity use and economic development in over 100 countries. They have found that for the global economy as a whole, there is a strong correlation between electricity use and wealth creation. Since correlation analysis does not involve causality, recent studies, among them [Ghosh \(2002\)](#), [Shiu and Lam \(2004\)](#), [Moritomo and Hope \(2004\)](#), [Jumbe \(2004\)](#), [Wolde-Rufael \(2004\)](#), [Narayan and Smyth \(2005\)](#), and [Yoo \(2005\)](#), have focused on the casual relationship between electricity consumption and economic growth for several developing countries. This kind of information is useful for making inference about the energy policy implications. This study aims at investigating the causality between electricity consumption at disaggregated level and income in Turkey, as an extension of [Altınay and Karagol \(2004\)](#) in which they investigated the causal relationship between aggregated energy consumption and income for the period of 1950–2000, during which Turkey experienced many economic crises and shortages of electricity supply.

Like other developing countries, Turkey also faces an ever increasing electricity demand. For example, between 1980 and 2000, the average growth rate of total electricity consumption in Turkey has been 8.1% per annum, while the real GDP has grown about 4.4% annually on average during the same period. The electricity consumption per capita has also steadily grown from 459 kW h in 1980 to 1457 kW h in 2000, which is, however, still low compared to other OECD countries. Turkey faced some shortages of electricity supply during the early 1980s and the 1990s, the period which is also marked by economic crises. The insufficient public funds and the poor performance of the state-owned electricity monopolies have led to a reform in electricity sector, aiming at a competitive energy market, after the economic crisis in 2001 (see [Özkivrak, 2005](#) for an account of electricity sector in Turkey).

In analyzing the causal relationship between income and energy consumption there are two approaches in empirical studies: multivariate approach and bivariate approach. Following [Stern \(1993\)](#) that uses a four-variable vector autoregressive (VAR) model for the USA in the post-war period, [Masih and Masih \(1997, 1998\)](#), [Asafu-Adjaye \(2000\)](#), [Stern \(2000\)](#), [Oh and Lee \(2004\)](#), and [Narayan and Smyth \(2005\)](#), among others employ a multivariate model. These studies usually investigate the relationship between GDP and energy within a production function model; hence a multivariate model naturally includes GDP, energy, labour and/or capital, as well as technological change.

On the other hand, several studies use a bivariate model in detecting the causality between GDP and energy. For example, [Ghosh \(2002\)](#), [Soytas and Sari \(2003\)](#), [Shiu and Lam \(2004\)](#), and [Yoo \(2005\)](#) among others have focused just on the directionality of causality. Electricity consumption constitutes a small fraction of the total energy consumption in Turkey, although its share increases year by year. On the other hand, the share of industrial electricity consumption, which was 77% in 1950 and 57% in 2000, is declining, while the share of residential electricity consumption is on the rise. Therefore, a complete model in the view of a production function should include all types of energy, as well as the other production factors. To simplify the analysis we have adopted a bivariate approach in detecting the direction of causality between the total electricity consumption and the real GDP in Turkey. A specification bias due to excluded variables may occur, but different methods will be employed to check the robustness of the causality results.

The organization of the study is as follows. In the second section the econometric methodology that will be employed is explained. In the third section the data used and the

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