



# A dynamic panel study of economic development and the electricity consumption-growth nexus

Nicholas Apergis<sup>a</sup>, James E. Payne<sup>b,\*</sup>

<sup>a</sup> Department of Banking and Financial Management, University of Piraeus, Karaoli and Dimitriou 80, Piraeus, ATTIKI 18534, Greece

<sup>b</sup> Department of Economics, Illinois State University, Normal, IL 61790-4100, United States

## ARTICLE INFO

### Article history:

Received 24 May 2010

Received in revised form 21 December 2010

Accepted 23 December 2010

Available online 20 January 2011

### JEL Classification:

C33

O1

O4

O50

Q4

### Keywords:

Electricity consumption

Growth

Panel

Granger-causality

## ABSTRACT

This study examines the relationship between electricity consumption and economic growth for 88 countries categorized into four panels based on the World Bank income classification (high, upper middle, lower middle, and low income) within a multivariate panel framework over the period 1990–2006. The Larsson et al. (2001) panel cointegration test indicates there is a long-run equilibrium relationship between real GDP, coal consumption, real gross fixed capital formation, and the labor force for the high, upper middle, and lower middle income country panels. The results from the panel vector error correction models reveal (1) bidirectional causality between electricity consumption and economic growth in both the short- and long-run for the high income and upper-middle income country panels; (2) unidirectional causality from electricity consumption to economic growth in the short-run, but bidirectional causality in the long-run for the lower-middle income country panel; and (3) unidirectional causality from electricity consumption to economic growth for the low income country panel.

© 2011 Elsevier B.V. All rights reserved.

## 1. Introduction

Electricity serves an important role in both the production and consumption of goods and services within an economy. The availability of electricity has been a major contributor to the technological and scientific advancements that have improved the standard of living across countries. With population growth, urbanization, and industrialization of economies, the infrastructure for electricity has emerged as an important factor in a country's growth prospects. Furthermore, the growth of the information and communication technologies in advanced economies confirms the importance of electricity. In a study of over 100 countries, Ferguson et al. (2000) present evidence of a high correlation between electricity usage and the level of economic development and growth. However, a high correlation does not necessarily imply a causal relationship. Thus, understanding the causal relationship between electricity consumption and economic growth is important in the design and effectiveness of energy and environmental policies.

The causal relationship between electricity consumption and economic growth can be broken down into four testable hypotheses.

First, the growth hypothesis asserts that electricity consumption has a significant influence on economic growth directly and/or as a complement to labor and capital in the production process. The growth hypothesis is supported if there is unidirectional causality from electricity consumption to economic growth. In this context, energy conservation policies which reduce electricity consumption may have an adverse impact on economic growth. Second, the conservation hypothesis stipulates that electricity consumption is driven by economic growth. The conservation hypothesis is confirmed if there is unidirectional causality from economic growth to electricity consumption. Under this scenario, energy conservation policies designed to reduce electricity consumption may not have an adverse impact on economic growth. Third, the feedback hypothesis emphasizes the interdependent relationship between electricity consumption and economic growth. The feedback hypothesis is confirmed by the presence of bidirectional causality between electricity consumption and economic growth. This complementary relationship opens the possibility that energy conservation policies which reduce electricity consumption may impact economic growth. Likewise, such fluctuations in economic growth may very well be transmitted back to electricity consumption. Finally, the neutrality hypothesis assumes that electricity consumption plays a relatively minor role in economic growth. The neutrality hypothesis is supported by the

\* Corresponding author. Tel.: +1 309 438 5669.

E-mail addresses: [napergis@unipi.gr](mailto:napergis@unipi.gr) (N. Apergis), [jepayne@ilstu.edu](mailto:jepayne@ilstu.edu) (J.E. Payne).

**Table 1**  
Summary of the electricity consumption-economic growth literature.

Author(s)	Countries	Methodology	Main variables	Other variables	Conclusion(s)
Murray and Nan (1996)	Canada (1970–1990A) Colombia (1970–1990A) El Salvador (1970–1990A) France (1970–1990A) Germany (1970–1990A) Hong Kong (1970–1990A) India (1970–1990A) Indonesia (1970–1990A) Israel (1970–1990A) Kenya (1970–1990A) Luxembourg (1970–1990A) Malaysia (1970–1990A) Mexico (1970–1990A) Norway (1970–1990A) Pakistan (1970–1990A) Philippines (1970–1990A) Portugal (1970–1990A) Singapore (1970–1990A) South Korea (1970–1990A) Turkey (1970–1990A) UK (1970–1990A) US (1970–1990A) Zambia (1970–1990A)	Granger-causality; VAR	Electricity consumption; real GDP		Canada, ELC → Y Colombia, Y → ELC El Salvador, Y → ELC France, ELC ≠ Y Germany, ELC ≠ Y Hong Kong, ELC → Y India, ELC ≠ Y Indonesia, Y → ELC Israel, ELC ≠ Y Kenya, Y → ELC Luxembourg, ELC ≠ Y Malaysia, ELC → Y Mexico, Y → ELC Norway, ELC ≠ Y Pakistan, ELC → Y Philippines, ELC ≠ Y Portugal, ELC ≠ Y Singapore, ELC → Y South Korea, ELC → Y Turkey, ELC → Y UK, ELC ≠ Y US, ELC ≠ Y Zambia, ELC ≠ Y
Yang (2000)	Taiwan (1954–1997A)	Engle-Granger; no cointegration; VAR	Electricity consumption; real GDP		Taiwan, ELC → Y
Aqeel and Butt (2001)	Pakistan (1955–1996A)	Engle-Granger; No cointegration; VAR	Electricity consumption per capita; real GDP		Pakistan, ELC → Y
Ghosh (2002)	India (1950–1997A)	Johansen-Juselius; no cointegration; VAR	Electricity consumption per capita; real GDP		India, Y → ELC
Fatai et al. (2004)	Australia (1960–1999A)	Granger-causality; Toda-Yamamoto; causality; ARDL bounds test; Johansen-Juselius; cointegration; VEC	Electricity consumption; real GDP	Consumer prices	Australia, JJ Y → ELC, TY Y → ELC, ARDL Y → ELC
Jumbe (2004)	Malawi (1970–1999A)	Engle-Granger; cointegration; VEC	Electricity consumption; GDP; agricultural GDP;		Malawi, ELC → Y
Morimoto and Hope (2004)	Sri Lanka (1960–1998A)	Engle-Granger; no cointegration; VAR	Electricity production; real GDP		Sri Lanka, ELP → Y
Shiu and Lam (2004)	China (1971–2000A)	Johansen-Juselius cointegration; VEC	Electricity consumption; real GDP		China, ELC → Y
Thoma (2004)	US (1973:1–2000:1M)	Engle-Granger; no cointegration; VAR	Total, commercial, industrial, other, and residential electricity usage; industrial production		US, IP → ELC, IP → CELC, IP → IELC, OELC ≠ IP, RELC ≠ IP
Wolde-Rufael (2004)	Shanghai (1952–1999A)	Toda-Yamamoto causality	Electricity consumption, real GDP		Shanghai, ELC → Y
Altinay and Karagol (2005)	Turkey (1950–2000A)	Dolado-Lutkepohl causality	Electricity consumption; real GDP		Turkey, ELC → Y
Lee and Chang (2005)	Taiwan (1954–2003A)	Johansen-Juselius; cointegration; VEC	Electricity consumption; real GDP per capita		Taiwan, ELC → Y
Narayan and Smyth (2005)	Australia (1966–1999A)	ARDL bounds test; cointegration; VEC	Electricity consumption per capita; real GDP per capita	Manufacturing employment index	Australia, Y → ELC
Yoo (2005)	Korea (1970–2002A)	Johansen-Juselius cointegration; VEC	Electricity consumption; real GDP		Korea, ELC → Y

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات