Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Policy Modeling 27 (2005) 891–903
Journal of Policy Modeling

Energy demand and economic growth: The African experience

Yemane Wolde-Rufael *

London Borough of Camden, Town Hall, Judd Street, London WC1H 9JE, UK

Received 1 September 2004; received in revised form 1 April 2005; accepted 1 June 2005
Available online 25 July 2005

Abstract

The paper investigates the long run relationship between energy use per capita and per capita real gross domestic product (GDP) for 19 African countries for the period 1971–2001 using a newly developed cointegration test proposed by [Pesaran, M. H., Shin, Y, & Smith, R. (2001). Bounds testing approach to the analysis of level relationships. *Jounal of Applied Econometrics*, *16*, 289–325], which is capable of testing for the existence of a long run relationship regardless of whether the underlying time series are individually $I(0)$, $I(1)$ or mutually cointegrated. The paper also uses the [Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated process. *Jounal of Econometrics*, *66*, 225–250] version of the Granger causality test which is valid regardless of whether a series is $I(0)$, $I(1)$ or $I(2)$, non-cointegrated or cointegrated of any arbitrary order. The empirical evidence shows that there was a long run relationship between the two series for only eight countries and causality for only 10 countries.

JEL classification: C22; Q43

Keywords: Africa; Energy consumption; Bounds test; Causality

1. Introduction

Despite the fact that Africa has been endowed with the widest possible range of energy resources, that far exceed its energy requirements, Africa's power sector remains severely

* Tel.: +44 20 7974 1997; fax: +44 20 7974 5947.
E-mail address: yemane.wolde-rufael@camden.gov.uk.

0161-8938/$ – see front matter © 2005 Society for Policy Modeling. Published by Elsevier Inc. All rights reserved.
doi:10.1016/j.jpolmod.2005.06.003

underdeveloped in all countries and energy consumption in general and electricity consumption in particular is relatively very low (Karekezi & Kimani, 2002 and Economic Commission for Africa, ECA, 2004). The average African is still using less energy than the average person used energy in England more than a century ago (Davidson & Sokona, 2002). Per capita use of primary energy in North America was 280 GJ in 2000, more than 11 times as much as used by an average Sub-Saharan African, who used 25 GJ that year when both commercial and non-commercial energy was included (UNDP, 2004). The disparity in energy consumption let alone between Africa and the rest of the world even among African countries themselves is glaring. It ranges from as low as 262 kg of oil equivalent per capita in Uganda to as high as 1332 in Gabon (World Bank, 2004). With only 23% of its population electrified compared to the world average of 73%, Africa has the lowest electrification rate of any major world region (IEA, 2002). More than 500 million Africans are still without access to electricity. To make matters still worse, while the world electricity per capita consumption has been rising steadily over the past three decades, Sub-Saharan Africa's per capital electricity consumption has been stagnant. In fact, the electricity per capital consumption of Sub-Saharan African countries (excluding South Africa) declined from 132.6 kWh in 1980 to 112.8 kWh in 2000 (World Bank, 2004). To aggravate the problem further, less than 10% of the Sub-Saharan Africa population has access to electricity with electricity largely confined to the energy-intensive sub-sector of the commercial and industrial enterprises and to the high-income households while the electrification of the rural and urban poor is 'woefully inadequate' or non-existent (Karekezi, 2002). The number of people without electricity in Africa has doubled in rural areas and tripled in urban areas in the last 30 years (IEA, 2002). Most of the people without access to electricity in 2030 will still be in Sub-Saharan Africa (650 million) and South Asia (680 million) (IEA, 2002) with the population of Sub-Saharan Africa without electricity increasing steadily until 2025. It is estimated that at the rate of connections of the past decade, it would take more than 40 years to electrify South Asia and almost twice as long for Sub-Saharan Africa (IEA, 2002). Further, if the transition to modern fuels is usually complete by the time per capita income reaches US$ 1000–1500 (Toman & Jemelkova, 2003), many Sub-Sahara Africa countries have a long way to go and access to modern energy for the poor, to borrow words from Karekezi and Kimani (2002), is a dream that is unlikely to be realised in the near future.[1]

While the availability of modern energy is not by itself a panacea for the economic and social problems facing Africa, the supply of modern energy is nevertheless believed to be a necessary requirement for Africa's economic and social development (IEA, 2002). Electricity and other modern energy sources are necessary requirements for economic and social development (IEA, 2002). "No country in the world has succeeded in shaking loose from subsistence economy without access to the services of modern energy provides" (World Bank, n.d.). Apart from the physical availability of energy, change in the quality of energy service is one of the most important drivers of economic productivity (see Toman & Jemelkova, 2003). The process of economic development necessarily involves a transition from low levels of energy consumption to higher levels where the linkages among energy, other factor inputs and economic activity change significantly as an economy moves through

[1] For a good summary of the energy problem in Africa, see Iwayemi (1998).