



Electricity consumption and economic growth: Bounds and causality analyses of OPEC members

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Abstract

This paper investigates the relationship between electricity consumption and economic growth for OPEC members. The bounds test yields evidence of a long-run relationship between electricity consumption and economic growth for all OPEC members. Causality results suggest that economic growth is dependent on electricity consumption in five countries, less dependent in three countries, and independent in three countries. Because these countries do not necessarily share similar political and economic traits, no single universal policy implication can be inferred from the results. The disparities across these causality results, therefore, stress the importance of formulating causality explanations while taking into account the particularities of individual countries rather than blindly applying the conventional interpretations.

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1. Introduction

This paper investigates the long-run relationship and causality between electricity consumption and economic growth for the Organization of Petroleum Exporting Countries (OPEC) using the bounds test of [Pesaran et al. \(2001\)](#) and the non-causality test of [Toda and Yamamoto \(1995\)](#). These tests are useful in assessing the degree of dependence on electricity across OPEC members. This is important because when a country's economy is heavily dependent on electric energy, environmental policies for energy conservation could adversely affect economic growth. Therefore, the understanding of the direction of causality between electricity and economic growth could have important policy implications.

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There has been an on-going debate about to what extent abundant natural resources may undermine political institutions, induce corruption and rent-seeking behavior, promote the misallocation and mismanagement of resources, and stifle economic progress. This is commonly referred to as the “resource curse” (Auty, 1993). In fact, there is empirical evidence linking resource abundance with poor economic growth (Sachs and Warner, 1995). More specifically, over a period of 33 years, since 1965, OPEC members experienced an average decrease of 1.3% in per capita gross national product versus an average growth rate of 2.2% in the rest of the developing world (Gylfason, 2000). Fortunately, oil and gas abundance has allowed most OPEC members to benefit from high electrification rates currently exceeding 94% for most OPEC members except for Indonesia and Nigeria, which stand at about 53% and 40% respectively (International Energy Agency (IEA), 2002).

Two strands are identified in the literature analyzing the relationship between energy consumption and economic growth. The first strand includes the proponents of energy consumption as a primary means to achieve economic growth. Energy is expected to play a primary role in achieving economic, social, and technological progress and to complement labor and capital in production (Dunkerley, 1982; Ebohon, 1996; Templet, 1999). The second strand describes the role of energy as minimal or neutral and is commonly referred to as the “neutrality hypothesis” (Yu and Choi, 1985). This hypothesis stems from the fact that energy consumption, and electricity in particular, should not affect economic growth because it represents too small of a proportion of a country’s gross domestic product.

According to the empirical literature analyzing causality between energy consumption and economic growth, when causality flows from energy to income, then an economy is theoretically dependent on energy and economic growth can be adversely affected by a reduction in energy consumption. When causality flows from income to energy, then an economy is relatively less dependent on energy and environmental policies for energy conservation would have little to no impact on economic growth. Bi-directional causality, on the other hand, suggests that energy and economic growth complement each other.¹

These theoretical contentions have been generally based on positive causality, however when causality is negative, the energy dependence interpretation becomes less intuitive and opens the door to a number of alternative interpretations. In fact, when causality flows negatively from energy to income, then increasing energy consumption leads to lower economic growth. Intuitively, this could simply describe a growing economy that requires a decreasing amount of energy, potentially consistent with the contention that as an economy grows, production ought to shift to less energy intensive service sectors (Wolde-Rufael, 2005). However, because of political, economic, and social differences across OPEC members, interpretations of such a causality may be numerous. In fact, it can be argued that this negative causality from energy to economic growth can be the result of excessive use of energy in unproductive sectors coupled with capacity constraints or an inefficient supply of energy.²

When causality flows negatively from income to energy, then increased economic growth results in reduced energy consumption. The interpretation of such a causality is not so clear as several factors may be the culprit in the adverse impact on energy consumption. In fact, an economy, although growing, may be constrained by infrastructural, political, or managerial obstacles, which may put downward pressure on energy consumption. Moreover, political factors coupled with the

¹ See Lee (2005) for a review of the empirical literature.

² It is not uncommon for countries that are endowed with abundant oil, such as Nigeria, to experience interruptions in their energy supply (Wolde-Rufael, 2005).

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