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The relationship between energy consumption, energy prices and economic growth: time series evidence from Asian developing countries ☆

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Abstract

This paper estimates the causal relationships between energy consumption and income for India, Indonesia, the Philippines and Thailand, using cointegration and error-correction modelling techniques. The results indicate that, in the short-run, unidirectional Granger causality runs from energy to income for India and Indonesia, while bidirectional Granger causality runs from energy to income for Thailand and the Philippines. In the case of Thailand and the Philippines, energy, income and prices are mutually causal. The study results do not support the view that energy and income are neutral with respect to each other, with the exception of Indonesia and India where neutrality is observed in the short-run.

JEL classifications: C22; Q43; Q48

Keywords: Energy consumption; Economic growth; Granger causality

1. Introduction

In the past two decades numerous studies have examined the causal relationships between energy consumption and economic growth, with either income or

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employment used as a proxy for the latter. To date, the empirical findings have been mixed or conflicting. The seminal article on this topic was published in the late seventies by Kraft and Kraft (1978) who found evidence in favour of causality running from GNP to energy consumption in the United States, using data for the period 1947–1974. Their findings were later supported by other researchers. For example, Akarca and Long (1979) found unidirectional Granger causality running from energy consumption to employment with no feedback, using US monthly data for the period 1973–1978. They estimated the long-run elasticity of total employment with respect to energy consumption to be -0.1356.

However, these findings have been subjected to empirical challenge. Akarca and Long (1980), Erol and Yu (1987a), Yu and Choi (1985), and Yu and Hwang (1984) found no causal relationships between income (proxied by GNP) and energy consumption. On the causal relationship between energy consumption and employment, Erol and Yu (1987b, 1989), Yu and Jin (1992), and Yu et al. (1988) found evidence in favour of neutrality of energy consumption with respect to employment, referred to as the 'neutrality hypothesis'.

One of the reasons for the disparate and often conflicting empirical findings on the relationship between energy consumption and economic growth lies in the variety of approaches and testing procedures employed in the analyses. Many of the earlier analyses employed simple log-linear models estimated by ordinary least squares (OLS) without any regard for the nature of the time series properties of the variables involved. However, as has recently been proven, most economic time series are non-stationary in levels form (see Granger and Newbold, 1974). Thus, failure to account for such properties could result in misleading relationships among the variables.

Following advances in time series analysis in the last decade, recent tests of the energy consumption–economic growth relationship have employed bivariate causality procedures based on Granger (1969) and Sims' (Sims, 1972) tests. However, these tests may fail to detect additional channels of causality and can also lead to conflicting results. For example, recently, Glasure and Lee (1997) tested for causality between energy consumption and GDP for South Korea and Singapore using the standard Granger test, as well as cointegration and error-correction modelling. They found bidirectional causality between income and energy for both countries, using cointegration and error-correction modelling. However, using the standard Granger causality tests, they found no causal relationships between GDP and energy for South Korea and unidirectional Granger causality from energy to GDP for Singapore.

The direction of causation between energy consumption and economic growth has significant policy implications. If, for example, there exists unidirectional Granger causality running from income to energy, it may be implied that energy conservation policies may be implemented with little adverse or no effects on economic growth. In the case of negative causality running from employment to energy (Akarca and Long, 1979), total employment could rise if energy conservation policy were to be implemented. On the other hand, if unidirectional causality runs from energy consumption to income, reducing energy consumption could lead