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## Energy, Economic Growth and Pollutant Emissions Nexus: The case of Malaysia

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### Abstract

The objective of this study is to investigate the causal relationships between energy consumption, economic growth and pollutant emissions for Malaysia over the period 1970-2010. By applying techniques of cointegration and vector error correction modelling, the result shows the existence of the long-run relationship between energy consumption, economic growth and emission. The results also point to a unidirectional causality running from economic growth to energy consumption, from pollutant emissions to energy consumption and from pollutant emissions to economic growth.

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### 1. Introduction

In recent years, there has been a vast increase in awareness in the environment and its interaction with the economy. In general, there is interdependence between the economy and the environment and this interdependence operates in both directions. For instance, economic development can have major impact on the environment and in the long run, environmental change may have feedback effects to the economy. As Malaysia's economic activities globalize, there is a strong interactive connections between economic and energy supply and demand. Malaysia energy sector is still heavily dependent on fuel such as crude oil, natural gas and coal as a source of energy. Today, around 95% of the Malaysia's energy demands are met by fossil fuels, which will continue to be the predominant source of energy. However, at the same time, the consumption of these non-renewable fuels is gradually depleting and can contribute to huge

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amount of greenhouse gas emission (GHG). Therefore, considering to this scenario, there is an interesting question needs to be considered. Will Malaysia be able to sustain economic growth without running into resource constraints or despoiling the environment? In order to overcome the phenomena, the government of Malaysia is aware of its role in formulating its national energy development policies, which is sensitive towards the environment and the sustainability of energy resources. However, to curb the greenhouse gas emissions and to ensure the sustainability of the economic development, it is important to better understand the link between greenhouse gas emission, energy consumption and economic growth.

In the energy economics literature, the linkages between energy and the economy have been addressed in several ways, which largely reflect the theoretical background of each approach. Within the neoclassical theory of economic growth, the focus has been on the interaction between energy, technical progress, productivity as well as examining the substitutability or complementarity between energy and other factors of production (Berndt and Wood, 1975). This framework is also supported by Ghali El-Sakka (2004) and Soytaş and Sari (2007) where they viewed energy as an important input in the production process. In the same context, but from a different perspective, Toman and Jemelkova (2003) examine the relationship of energy development with economic development, that is, how energy usage is driven by economic development. They claimed that the linkages among energy and economic growth vary with the stages of the development process and conclude that energy development is an important component of economic development. For instance, at the lowest level of development, energy mainly comes from biological sources (wood, dung, sunshine for drying) and human effort. In the intermediate stages, more processed biofuels (charcoal/fuel wood), animal power and some commercial fossil energy become more important. In the most advanced stages of development, commercial fuels like electricity become prevalent. In contrast to the above study, Stern and Cleveland (2004) adopt a different point of view on the relationship between energy and economic development. Building on a strand of ecological economics, they emphasize that there are limits to both technical progress and substitution possibilities between inputs (i.e. energy, capital, labour, etc.) in the production process (Stern, 1997). Therefore, they suggest that all economic processes require energy as an essential factor of production and conclude that energy is necessary for growth.

Based on the above discussions, there are four views exist regarding the causal relationship between energy consumption and economic growth. The first view considers economic development as the main driver for energy demand. The second view stressed the importance of considering energy as an essential factor of production and thus suggested that energy is necessary for economic growth. The third view contends that both energy consumption and economic growth cause each other, i.e. that there is a bi-directional causality between energy consumption and economic growth. The fourth view argues that there is no causal relationship between energy consumption and economic growth.

Empirical findings, on the other hand, are not unanimous in their results and this leads to a commonly accepted conclusion that the discussion on the interactions of energy with the economy remains open to different interpretations. For instance, the first view has been widely supported by Azlina (2011) and Ang (2008) for the case of Malaysia, Zhang and Cheng (2009) for the case of China and Mozumder and Marathe (2007) for the case of Bangladesh. The empirical work, which is consistent with the second view, includes studies such as Menyah and Rufael (2010) for the case of South Africa and Narayan and Smyth (2008) for the case of G7 countries. The third view, which maintains that both energy consumption and economic growth Granger cause each other has been widely supported by studies such as Chang (2010) for China and Paul and Bhattacharya (2004) for India. Finally, the fourth view has been supported by the studies of Jobert and Karanfil (2007) and Altınay and Karagöl (2004), both for the case of Turkey.

Recently, there is an emerging line of literature to analyze the linkages between energy consumption and economic growth due to the increasing attention of environmental issues and policies needed to reduce greenhouse gas emissions. Studies show that economic growth is major driving forces behind increased energy use and a cause of CO<sub>2</sub> emissions. See for example, Hamit-Hagggar (2012), Zhang and Cheng (2009) and Ang (2008), amongst others.

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