Economic Modelling 30 (2013) 435–441

Contents lists available at SciVerse ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

# Financial development and energy consumption nexus in Malaysia: A multivariate time series analysis

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ARTICLE INFO

*Article history:*
Accepted 17 September 2012

*Keywords:*
Financial development
Energy consumption
ARDL
Economic growth
Malaysia

ABSTRACT

Despite a bourgeoning literature on the existence of long run relationship between consumption of energy and economic growth, results on the direction of causality so far, remain elusive. A growing economy needs more energy, which is exacerbated by growing population. Evidence suggests that financial development can reduce energy use by increasing energy efficiency. Economic growth and energy consumption in Malaysia have been rising in tandem over the past several years. The three public policy objectives of Malaysia are: economic progress, population growth and financial development. It is of interest to the policymakers to understand the dynamic interrelation among the stated objectives. The paper explores the existence of a long run relation among energy use, aggregate production, financial development and population in Malaysia; and causality using the Vector Error Correction Model (VECM). The results suggest that energy consumption is influenced by economic growth and financial development, both in the short and the long run, but the population–energy relation holds only in the long run. The findings have important policy implications for balancing economic growth vis-à-vis energy consumption for Malaysia, as well as other emerging nations.

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## 1. Introduction

The nexus between economic growth and energy consumption has been a subject of considerable academic scrutiny over the past few decades. Even so, the available evidence on the direction of the causality so far has been inconclusive. As the race for economic prosperity by major emerging nations intensifies, the importance of the topic will grow further. Energy is the key to the production of goods and services. Many emerging economies are growing at a pace much faster than were projected earlier. This has created a spurt in the demand for energy. Although 2009 saw global economic recession, the major energy consuming nations in Asia – China and India – have hardly been affected. The International Energy Agency (IEA) (2009) reports that the global energy use is expected to fall significantly, in 2009, the first time since 1981. However, the demand should be back on the long-term up-trend once economic recovery gathers pace. Barring major policy changes, global demand for primary energy is projected to rise by 40% in 2030 from its 2007 level. Collectively, the non-OECD nations will account for over 90% of this increase. Their share of global primary energy demand will rise from 52% to 63%. China and India will account for over 53% of the increase by 2030. Use of fossil fuels will continue to dominate the scenario, accounting for 77% of the increase. Oil demand is projected to rise from the 85 million barrels per day in 2008 to 105 million in 2030, a 24% rise (World Energy Outlook, 2012).

The objective of the present paper is to examine a long run relationship among consumption of energy, financial development, economic growth, and population for Malaysia by implementing the autoregressive distributed lag (ARDL) approach to cointegration; and test the direction of causality using the Vector Error Correction Models (VECM). As an important economic player in East Asia, Malaysia has been a poster child for her success in the East Asian region. Since the independence in 1959 the resource rich nation has successfully prosecuted a policy of enviable economic growth. The strategy has paid off. Malaysia boasts of being among the emerging nations with the highest rates of economic growth. However, notable spurt in energy consumption and a concomitant rise in pollutant emissions in recent times have made the choice of Malaysia not only timely but also of much significance. In particular, the paper is motivated by the need to reexamine the findings by Ang (2008) and Masih and Masih (1996a). They used the Johansen–Juselius procedure to examine the Malaysian energy economic growth nexus. From econometric perspectives, we argue that the ARDL bounds testing approach is preferable to other methods due to small sample size.

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0264-9993/$ – see front matter. Published by Elsevier B.V.
http://dx.doi.org/10.1016/j.econmod.2012.09.033

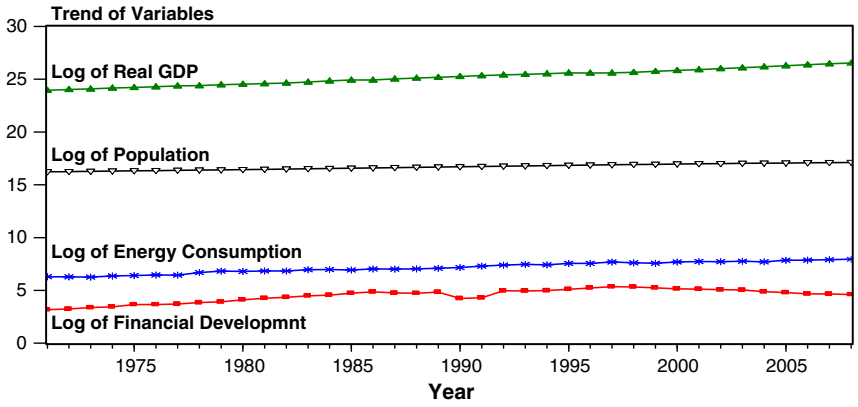


**Fig. 1.** Trends in the series used here to explore long run relation.

Given that the three major public policy goals of Malaysia are: economic growth, financial development and population growth, it is of interest to know how they interact, inter alia. An understanding of long and short run causality among the series and their direction, if any, is more than a matter of just intellectual curiosity — they have significant policy implications. Masih and Masih (1996b) found no cointegration and Ang (2008) found only unidirectional causality for Malaysia. Against the backdrops, the need to explore long run relation and causal link among financial development, population, economic growth and energy use in Malaysia gains particular importance. We find bidirectional causality between financial development and energy consumption, energy consumption and economic growth, financial development and economic growth and, financial development and population in long run. However, the causality for energy consumption to economic growth holds only for the short run. Thus the paper can be seen as a modest contribution to the existing literature. Our findings are intuitively more appealing compared to those reported by the above two authors.

$CO_2$ emission in Malaysia has increased by 221% during 1990 to 2004 period which lists the nation at 26th among the top 30 greenhouse gas emitters. If the current rate of emissions persists, Malaysia may move up the ladder. As a signatory to Kyoto Protocol, Malaysia did little to change the rapid growth in emissions (Liebman, 2007). However, the several initiatives taken by the government to harness renewable energy and to cut $CO_2$ emissions are reassuring. The paper finds that financial development helps energy consumption and economic growth. The results might help policymakers craft appropriate strategy for sustainable economic growth.

Energy consumption depends on the stage of economic growth. The latter is necessary to insure better standards of living. The heightened interest by the major economic powers at gaining a firm foothold on energy rich regions across the globe is a testimony to the fact that energy will remain a major focus for the foreseeable future. The battle for such control will also intensify as more energy will be needed by the fastest growing economies. Energy-related greenhouse gases (GHG) make up the bulk of pollutants. Knowledge of the determinants of energy demand can help manage global emissions of GHGs. World Resources Institute (WRI) reports that developed countries once were the major emitters of most of the worlds GHG but the emerging nations have now taken that spot. The latter nations have set long run economic growth as their core mission. The situation may be exacerbated by higher population growth in many parts of the world. Rapid population growth can be unfavorable to environment.

**Table 1**
Statistical output for unit root test (Ng-Perron).

| Variables | MZa | MZt | MSB | MPT |
|---|---|---|---|---|
| $\ln EC_t$ | −9.67 | −2.15 | 0.22 | 9.61 |
| $\ln GDP_t$ | −10.90 | −2.29 | 0.21 | 8.53 |
| $\ln POP_t$ | 2.36 | 2.03 | 0.85 | 197.86 |
| $\ln FD_t$ | −4.20 | −1.18 | 0.28 | 19.21 |
| $\Delta \ln EC_t$ | −20.47** | −3.19 | 0.15 | 4.45 |
| $\Delta \ln GDP_t$ | −23.90* | −3.45 | 0.14 | 3.81 |
| $\Delta \ln POP_t$ | −21.48** | −3.20 | 0.14 | 4.66 |
| $\Delta \ln FD_t$ | −40.07* | −4.47 | 0.11 | 2.27 |

The * and ** denote rejection of the null at the 1% and 5% levels, respectively.

Using US data for 1947–1974, Kraft and Kraft (1978) found unidirectional causality from output to energy consumption. Masih and Masih (1996a) found cointegration between energy use and GDP in India, Pakistan, and Indonesia, but no cointegration for Malaysia, Singapore and the Philippines. The same study also found causality flows from energy to GDP in India; and from GDP to energy in Pakistan and Indonesia. Asafu-Adjaye (2000) found causality from energy to income in India and Indonesia, and a bidirectional causality in Thailand and the Philippines. Soytas and Sari (2003) found bidirectional causality in Argentina; from GDP to energy use in Italy and Korea; and from energy use to GDP in Turkey, France, Germany and Japan. Wietze and Montfort (2007) also found energy use and GDP are cointegrated in Turkey, and causality runs from GDP to energy use. Al-Iriani (2006) reported unidirectional causality from economic growth to energy consumption in six Gulf Cooperation countries. Using data from over hundred nations, Chontanawat et al. (2008) found that energy consumption Granger causes economic growth in only 35% of the poorest, 42% of the middle-income and 69% of the high-income nations. Huang et al. (2008) did not find causality between energy use and economic growth in low-income groups, but found economic growth in middle- and high-income countries leads to higher energy use. Lee and Chang (2008) report long run causality from energy use to economic growth; and a bidirectional causality among energy use, capital stock and economic growth for 22 OECD nations. Narayan and Smyth (2008) showed that capital formation and energy use affect real GDP positively in the long run for the G7 countries.

Many studies show that population and economic growth boost energy use; as well as $CO_2$ emissions. Batliwala and Reddy (1993) pointed out that energy demand depends on per capita energy use. Energy needs in several African Asian urban centers are being met from bio fuel. That might change as more urbanization and industrialization take place. Dietz and Rosa (1997) and York et al. (2003) found that the elasticity of $CO_2$ emissions and energy use with respect to population is close to unity. As living standards rise and population continues to grow, so do energy use and $CO_2$ emissions in city areas (Fong et al., 2007a,b; IGES, 2004).

The theoretical literature on the financial development and economic growth nexus is well established. In this paper we try to show the link between financial developments and energy use. The basic argument is that the existence of well-developed financial market boosts domestic investment and encourages FDI inflow inter alia, which brings both superior technology and know-how. Both of the