Energy Policy ∎ (∎∎∎∎) ∎∎∎–∎∎∎

Contents lists available at ScienceDirect

Energy Policy

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

Investigation of the environmental Kuznets curve for carbon emissions in Malaysia: Do foreign direct investment and trade matter?

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HIGHLIGHTS

- Examining environmental Kuznets curve hypothesis by incorporating FDI and trade.
- FDI promotes higher economic growth and leads to higher environmental degradation.
- Both FDI and trade directly influence CO_2 emission and economic growth.
- Attraction of technology-oriented FDI is crucial for the quality of environment.

ARTICLE INFO

Article history:
Received 25 October 2013
Received in revised form
26 December 2013
Accepted 4 January 2014

Keywords:
Environmental Kuznets curve
Carbon dioxide emissions
Economic growth

ABSTRACT

Environmental degradation has become a central issue of discussion among the economists and environmentalists. In view of Malaysia's position as one of the main contributors to CO_2 emissions in Asia and its status as a fast growing economy, it is vital, therefore, to conduct a study to identify the relationship between economic growth and CO_2 emissions for Malaysia. This study attempts to examine empirically the environmental Kuznets curve hypothesis for Malaysia in the presence of foreign direct investment and trade openness both in the short- and long-run for the period 1970 to 2008.The bounds testing approach and Granger causality methodology are applied to test the interrelationships of the variables. The results of our study indicate that the inverted-U shaped relationship does exist between economic growth and CO_2 emission in both the short- and long-run for Malaysia after controlling for two additional explanatory variables, namely FDI and trade. Importantly, the results of the study also provide some crucial policy recommendations to the policy makers.

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1. Introduction

In recent years, the issue of climate change due to global warming has become a major worldwide concern. Based on the report of Intergovernmental Panel on Climate Change (IPCC) of 2007, it is estimated that the average global temperature would increase between 1.1 °C and 6.4 °C in the next century. Most importantly, an increase of merely 2 °C would expect to lead to a major change to natural ecosystems and a rise of sea levels that may threaten the lives of 50% of the world population who live in coastal areas (Lau et al., 2009). Scientists have found that the major greenhouse gas, i.e. carbon dioxide (CO_2) as the main culprit contributing to the problem of global warming. Unlike other pollutants such as sulfur dioxide (SO_2) in which their impact is more local, carbon dioxide emissions cause problems on a global scale (Fodha and Zaghdoud, 2009). As a result, the question of whether economic growth would lead to more CO_2 emissions has become a central issue of discussion among both the economists and environmentalists (Pearson, 1994; Stern et al., 1996; Dinda, 2009).

Countries are particularly interested in the relationship between environmental degradation and economic development which is of great relevance to policy making. In recent years, numerous studies have tried to establish the connection between pollution and income (Pearson, 1994; Stern et al., 1996; Dinda, 2009). These studies have proposed that there is an inverse-U-shaped relationship between income and environmental quality in which environmental quality worsens at low levels of income, and then improves as income increases.

A number of studies confirmed the existence of the inverted U-shaped relationship in their studies. These researchers include Dijkgraaf and Vollebergh (1998), Schmalensee et al. (1998), Kristrom and Lundgren (2003), Martinez-Zarzoso and Bengochea-Morancho (2004), Galeotti et al. (2005), Rezek and Rogers (2008), Jalil and Mahmud (2009), Lamla (2009), Pao and Tsai (2011), Han et al. (2011).

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0301-4215/$ - see front matter © 2014 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.enpol.2014.01.002

Please cite this article as: Lau, L.-S., et al., Investigation of the environmental Kuznets curve for carbon emissions in Malaysia: Do foreign direct investment and trade matter? Energy Policy (2014), http://dx.doi.org/10.1016/j.enpol.2014.01.002

For instance, Jalil and Mahmud (2009) test the environmental Kuznets curve for China over the period of 1971–2005 and confirmed the existence of EKC for CO_2 emission. Similarly, a more recent research by Zanin and Marra (2012) has found that the inverted-U-shaped EKC is valid for France and Switzerland[1]. Using Autoregressive Distributed Lag (ARDL) model, Ahmed and Long (2012) attempt to study the relationship between economic growth and CO_2 emission for Pakistan using yearly data from 1971 to 2008. The results suggest that EKC hypothesis does exist in both the short run and long run in Pakistan. Further, Shahbaz et al. (2013) also found the same results for Romania using data from 1980 to 2010 after applying similar testing approach.

On the other hand, a positive linear relationship is obtained by Cialani (2007) who explores the relationship between CO_2 emission and GDP per capita in Italy during 1861 to 2002. The result indicates that the typical inverted "U" form of EKC is not confirmed with the data for Italy. Similarly, Akbostanci et al. (2008) argue that there is a monotonically increasing relationship between CO_2 emissions and per capita income in Turkey for the period 1968–2003 with the help of a time series model using cointegration analysis. The result shows that the EKC hypothesis does not exist and implies that pollution problem may persist even with economic growth[2].

Environmental degradation plays a vital role in determining income growth for a country. However, to our best knowledge, there is little direct empirical evidence to confirm that a strong connection between income and CO_2 emission does exist in a single country such as Malaysia, especially on the validity of environmental Kuznets curve (EKC) hypothesis. For example, a study by Vincent (1997) on Malaysian states covering the late 1970s through the early 1990s indicates that the relationship between one air and five water pollutants is not in harmony with the EKC hypothesis. More recently, Ang (2008) conducts a research to study the presence of the long-run relationship between three variables namely, output, pollution, and energy consumption in Malaysia from 1971 to 1999. A positive relationship has been found between pollution and output in the long run. However, the causality running from pollution to economic growth is rather weak. Lee (2009) uses Granger causality tests to investigate the existence of short-run and long-run link between FDI inflows, pollution and output in Malaysia for the period between 1970 and 2000. The results indicate that there is a short-run relationship between both the FDI inflows and pollution on output. However, by investigating the long run relationship and the causal relationship between income and CO_2 emissions in Malaysia, Saboori et al. (2012) confirm the existence of environmental Kuznets curve (EKC) hypothesis for the country both in the short and long run.

Obviously, the literature is yet to provide a definitive conclusion on this relationship in Malaysia. Indeed, some studies have found that the inverted U-shaped relationship is basically valid only between income level and some local pollutants (wastewater discharge, carbon monoxide emissions and sulphur dioxide emissions) as well as other factors (such as openness, trade, labour and energy consumption) (Soytas et al., 2006; Nasir and Rehman, 2011). In addition, Soytas et al. (2006) investigate the relationship between real output and CO_2 emissions in the U.S. by taking three more variables: labour, investment in fixed capital, and energy consumption into account. They conclude that income does not Granger-cause CO_2 emission in the long run. Hence, income growth by itself may not become a solution to environmental problems, which against the EKC hypothesis[3].

It is worth noting that there has not been a study on the relationship between economic growth and CO_2 emissions in Malaysia by incorporating two additional variables namely, foreign direct investment and trade openness into consideration. The increased dependency of countries' economic growth on foreign direct investment due to globalization has also led to deterioration of environmental quality. Besides that, foreign trade has also been confirmed to be a factor causing environmental degradation. Even though the focus of the study is on EKC, both foreign direct investment and trade openness are considered as control variables in the analysis as the variables have been found influencing environmental quality.

FDI may contribute to the linkages between CO_2 emissionand economic performance via two channels.First, foreign direct investment may lead to an increase in national output, and thus be positively related to per capita CO_2 emission. In their studies, Jensen (1996), Acharyya (2009) find that even though FDI can contribute to better economic growth, it may cause more industrial pollution and environmental degradation. Furthermore, in order to reduce cost on environmental controls, polluting industries and businesses will tend to be shifted to underdeveloped regions where environmental standards are relatively low, and turn these regions into pollution slums. Second, more efficient production technology may be used as a result of foreign direct investment, and thus causes a reduction in per capita CO_2 emission (Stretesky and Lynch, 2008). For example, List and Co (2000), Mielnik and Goldemberg (2002), Perkins and Neumayer (2008) conclude that the inflow of FDI leads to an improvement in environmental quality due to the enhancement of energy efficiency.

On the other hand, trade openness also plays a vital role in affecting environmental quality. Grossman and Krueger (1991), Copeland and Taylor (2004) suggest that the impact of trade liberalisation on environmental quality can be broken down into three independent effects, that are scale, technique, and composition effects. First, the scale effect implies that an increase in the magnitude of the economy′s outputs and inputs will lead to a substantial increase in pollution. Thus, it can be argued that economic growth has a negative impact on environmental quality. Second, the composition effect is based on change in structure of the economy. Environmental quality tends to improve as the structure of the economy changes from industrialisation to services and knowledge technology-intensive industry (Rezek and Rogers, 2008). In other words, it implies that the effect of economic development on environmental degradation is positive. Finally, the technology or productivity effect implies that as a wealthy nation can afford to spend more on R&D (Komen et al., 1997), economic growth leads to technological progress that replaces obsolete and dirty technologies with new and cleaner technologies, which improves environmental quality.

The study, therefore, attempts to fill the gap by examining the relationship between economic growth and CO_2 emissions in the presence of foreign direct investment and trade openness in Malaysia. Malaysia is chosen for two reasons. First, Malaysia is able to achieve sustainable growth for the past 40 years and its environmental quality has worsened tremendously in the recent

[1] The study was carried out using more flexible additive mix models in which the models are able to deal with nonlinear covariate effects and at the same time temporal error structure.

[2] These studies use different types of pollutants such as CO_2, SO_2, NO_2, smoke etc as the indicator for environmental quality. Further, the countries used in these studies are different. The results indicate that the relationship between economic growth and environmental degradation varies based on the selection of pollution indicator as well as the choice of countries.

[3] Interestingly, some other researchers report a monotonically increasing or decreasing or even N-shaped relationship between pollution and income. For example, He and Richard (2010) (monotonically increasing relationship), Focacci (2003) (monotonically decreasing relationship) and Hu and Huang)2008) (N-shaped relationship).

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