



Estimating the Environment Kuznets Curve hypothesis: Evidence from Latin America and the Caribbean countries



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ABSTRACT

This study explores the effect of economic growth (GDP), renewable energy consumption (RE) and financial development (FD) on CO₂ emission (CO₂) in Latin America and Caribbean countries. To achieve this goal, a panel CO₂ model was built over the period 1980–2010. The Kao cointegration test results revealed that the variables are cointegrated. The Fully Modified OLS (FMOLS) results indicated an inverted U-shape relationship between CO₂ and GDP, thus confirming the Environmental Kuznets Curve hypothesis. Furthermore, FMOLS results also revealed that FD can improve environmental quality by its negative long-run effect on CO₂. However, RE has no long-run effect on CO₂ indicating that the RE does not contribute to CO₂ reduction. The VECM Granger causality results revealed feedback causality between GDP, RE, FD and CO₂ in both short- and long-run. Additionally, Granger causality results also revealed that RE, GDP, and FD can be a good solution to reduce environmental damage since they have a causal effect on CO₂. This study shows the investigated countries should increase their banking loans on green energy, energy efficiency and energy saving projects to reduce environmental damage. In addition, the above recommendation can increase the contribution of renewable energy in reducing environmental damage.

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1. Introduction

The increasing environmental degradation became one of the major issues that the world is facing in the last three decades. This problem attracted the consideration of numerous researchers to

study the relationship between energy consumption, CO₂ emission and economic growth at the country-specific and/or regional levels. Despite the wide range of literature investigating this relationship, there is lack of research for Latin America and Caribbean countries namely Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. Based on the Energy Information Administration (EIA) [52], these countries witnessed a high increase in CO₂ emission that more than doubled during the last three

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decades. The increase in pollution levels encouraged the governments of these countries to use renewable energy, which in turn increased the consumption of renewable energy tremendously over the same period. Moreover, these countries introduced many programmes and strategies to improve energy efficiency by increasing the role of renewable energy and other alternative fuels, energy saving projects and energy conservation [60]. Furthermore, the increase in financial development in these countries indicated by broad money, domestic credit by banking sector and domestic credit to private sector by more than 45% might reduce environmental damage since a number of studies (which will be reviewed later on in this study) concluded that improvements in financial development will reduce environmental degradation through CO₂ emission. Thus, the increase in renewable energy and the other alternative fuels, the improvement in energy efficiency, energy saving and increase in financial development might improve their income quality which in turn reduce their CO₂ emission. Therefore, the Environmental Kuznets Curve (EKC) hypothesis may exist in these countries which explain that during early stages of development, the increase in income (GDP) will increase pollution due to the increase in income inequality. However, when the country reaches a highly developed level, the relationship between income and pollution becomes negative due to the fact that income quality is higher than income inequality. Moreover, the EKC hypothesis became an important subject among scholars and a significant feature in the literature of the environmental policy.

Thus, we attempt to assess the effect of output growth, renewable energy consumption and financial development on CO₂ emission in Latin America and Caribbean countries by testing the validity of the EKC hypothesis.

2. Literature review

Since the last three decades, many studies investigated the association between CO₂ emission, energy consumption and economic growth using various methods. For instance, Coondoo and Dinda [1] discovered that CO₂ emission caused economic growth in North America and Western Europe countries, Central and South America, Oceania and Japan. However, they found two-way causal link between CO₂ emission and economic growth in Asian and African countries. Pao and Tsai [2] found a feedback causality between energy consumption and CO₂ emission, and between energy consumption and economic growth while a one way causal relationship was found from CO₂ emission to economic growth in BRIC (Brazil, Russia, India, and China) countries. In the case of Greece, Hatzigeorgiou et al. [3] discovered that both energy consumption and CO₂ emission are Granger-caused by economic growth while a two-way causality was discovered between energy consumption and CO₂ emission. On the other hand, Wang et al. [4] revealed that CO₂ emission, economic growth and energy consumption shared a common trend. They also found feedback causality among these components in China. Similar results were found in Bangladesh by Alam et al. [5], in the Middle East and North African countries by Al-mulali [6], in Canada by Hagggar [7], in Brazil by Pao and Tsai [8], Russia by Pao et al. [9], in Europe by Acaravci and Ozturk [10]. A causal relationship was determined between energy consumption to CO₂ emission but the causality between CO₂ emission and economic growth in the United States likely to be neutral [11]. In addition, Zilio and Recalde [12] also detected that CO₂ emission and economic growth in Latin America and Caribbean countries are not related. Similar results were uncovered by Jafari et al. [13] in Indonesia.

In this part, this study attempts to reviews the researches that explored the relationship between electricity consumption and

economic growth since a number of studies utilised electricity consumption from renewable sources as renewable energy consumption indicator. In the case of Hong Kong, Ho and Siu [14] detected that electricity consumption and economic growth were cointegrated and also found that electricity consumption Granger-caused economic growth but not evidence of reverse causation. Likewise, Ciarreta and Zarraga [15] in a number of European countries, Yuan et al. [16] in China, Ahamad and Islam [17] in Bangladesh, Chandran et al. [18] in Malaysia, Narayan and Prasad [19] in a number of OECD countries, and Narayan and Singh [20] in Fiji also found the same relationship. Comparable results were also found in ASEAN countries by Lean and Smyth [21] where CO₂ emission has a causal relationship with economic growth. However, the relationship between electricity consumption and economic growth varied across countries based on the level of income. This means two-way causal relationship between economic growth and electricity consumption was found in middle and high income countries while a one way causal relationship from electricity consumption to economic growth was found in low income countries [22]. Moreover, Mozumder and Marathe [23] found a one-way causal relationship from economic growth to electricity consumption in Bangladesh. Similar results were found by Jamil and Ahmad [24] in Pakistan. On the other hand, Narayan et al. [25] discovered two-way causal link between economic growth and electricity consumption in Western Europe, Asia, Latin America and African countries while a one way causal link from economic growth to electricity consumption was found in the Middle East countries. In addition, a cointegrated and bi-directional causal relationship between electricity consumption and economic growth was found in Burkina Faso [26]. Similar results were determined by Odhiambo [27] in South Africa, Shahbaz et al. [28] in Portugal, and Chen et al. [29] in 10 Asian countries. On the contrary, no relationship between electricity consumption and economic growth was found in MENA countries [30]. The same results were arrived at by Acaravci and Ozturk [31] in transition economies.

Few studies explored the relationship between renewable energy consumption and economic growth. In fact, most of these studies used electricity consumption from renewable sources to indicate renewable energy consumption. Fang [32] revealed that renewable energy consumption is important for economic growth in China. Salim and Rafiq [33] also found that income and CO₂ emission determines renewable energy consumption in a few emerging countries. Sadorsky [34] found similar results in the G7 countries. Apergis and Payne [35] determined long-run bi-directional causality in Central America between economic growth and renewable energy consumption. They found the same results in OECD countries [36], in 80 different countries [37], in Eurasian countries [38] and in Central America [35]. The same results were found by Apergis et al. [39] in a few developed as well as developing countries. They also uncovered that renewable energy consumption did not have any causal relationship with CO₂ emission. On the other hand, Marques and Fuinhas [40] found that renewable energy consumption had a negative effect on economic growth in a number of European countries due to the high costs of promoting renewables that are probably being placed excessively upon the economy.

A number of studies investigated the linkage among CO₂ emission, energy consumption and financial development. Shahbaz and Lean [41] found a long-run feedback causal relationship between energy consumption and financial development in Tunisia. Similar results were found by Zhang et al. [42] in China. Al-mulali and Che Sab [43] also found a long-run feedback causal relationship between CO₂ emission, energy consumption and financial development in Sub-Saharan African countries. The same researchers found the same results in 19 selected countries [44].

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