



Intercourse across economic growth, trade and renewable energy consumption in developing and developed countries



Fethi Amri

University of Charthage, Faculty of Economic Sciences and Management of Nabeul, Street Hammamet, Mrezgua, Nabeul 8000, Tunisia

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ABSTRACT

This article exploits a dynamic simultaneous-equation panel data approach to research the bond across economic growth, renewable sort of energy, and trade for information of 72 countries since 1990 until 2012. We likewise analyze this relationship by separating all countries into three groups as per the level of development: whole, developing, high-income developing, upper middle-income developing, lower middle-income developing, lower-income developing, developed, major developed, and others developed countries. The outcomes demonstrate a feedback linkage between income and renewable energy consumption, between trade and renewable energy consumption and between trade and income. This implies that the three variables considered are interdependent.

1. Introduction

Current studies inspecting the connection through economic growth, trade, and consumption of renewable energy are composed of three divisions.

The first division of researches investigated in the renewable energy consumption- economic growth nexus. The findings of this literature demonstrate the absence of consensus about the sense of causality among them. The results provide four types of assumption [1,2]. At first, the neutrality assumption sustained the absence of causality betwixt renewable energy and economic growth. It involves the absence of any link among them. For example, Payne [3] used yearly data United States during the phase 1949–2006 and deduced that the neutrality hypothesis is accepted. Analogously, Menegaki [4] examined the bond betwixt renewable energy consumption and gross domestic product (GDP) and in Europe in 11 years period (1997–2007). They rejected the possible association across them. In the same way, Omri et al. [1] implanted panel data models to explore the association among renewable energy, nuclear energy and gross domestic product in the case of 17 developing and developed countries. Their results confirmed the neutrality hypothesis in Switzerland, Brazil and Finland, between 1990 and 2011. Also, according to Yildirim et al. [5] there is no relationship between different categories of renewable energy and GDP in USA in the course of epoch moving from 1949 to 2010. Then, the feedback assumption sustained bidirectional links amongst renewable energy and output. It implicates that gross domestic product and renewable energy consumption are interrelated. In the Latin American countries study, Al-mulali et al. [6] used a multivariate panel data

model by integrating trade, non-renewable energy, labor and capital in Cob-Douglas production function. The outcomes indicate bi-directional causality among output and renewable energy. It implicates that policy makers should promote the renewable energy sources. Apergis and Payne [7] focused in Eurasian countries to study the link amongst renewable energy and output between 1990 and 2007. The results denote feedback linking between the two variables by building panel data models with additional variables (capital and labor). Apergis and Payne [8] used statistics of 80 countries to test the linkage among renewable energy and economic growth. The findings provide feedback relationship between them into panel data growth model. It illustrates that those countries should enforce the renewable energy promotion. Lin and Moubarak [9] interrogate the link amongst renewable energy and GDP by incorporating labor and CO₂ issuances in the multivariate model. They found that the feedback assumption is found in China study from 1977 to 2011. It implicates that the improvement of renewable energy is needful. Pao and Fu [10] substantiate the feedback causality between renewable energy and GDP in Brazil during the term 1980–2010. Shahbaz et al. [11] investigated the linking among renewable energy and output by means of the multivariate framework together with capital and labor forces as additional variables. They advanced bidirectional association among renewable energy and output in the example of Pakistani data from 1972 to 2011. Ohler and Fetters [12] found feedback linking between different forms of renewable energy and gross domestic product in OECD economies between 1990 and 2008.

Also, the conservation assumption sustained unidirectional assumption moving from gross domestic product to renewable energy.

E-mail address: fethiamri.fsegn@gmail.com.

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It demonstrates that economic growth helps to develop the renewable energy consumption. Tugcu et al. [13] examined the linking among GDP and renewable and non-renewable sorts of energy by means multivariate model. They concluded that conservation hypothesis is confirmed in Germany over the duration from 1980 to 2009.

Ocal and Aslan [14] stipulated unidirectional causality going from GDP to renewable energy in Turkish study during the epoch 1990–2010. Salim et al. [15] presented unidirectional relationship amongst GDP and renewable energy consumption in OECD economies from 1980 to 2011. At last, the growth assumption sustained unidirectional assumption going from renewable energy to GDP. It implicates that renewable category of energy consumption is a fundamental factor of output. Fang [16] studied the linkage among renewable energy and gross domestic product in the example of China from 1980 to 2010. The estimation of a multivariate model with labor and capital factors proves the positive impact of renewable energy on GDP. Pirlogea and Cicea [17] show unidirectional link from GDP to renewable energy in Romania during the epoch 1990–2010. Inglesi-Lotz [18] audited the relationships amongst renewable energy consumption and gross domestic product from 34 OECD economies during the interval 1990–2010. The attainments prove that there is a positive association between renewable energy and GDP. It implies that OECD countries should focus on renewable energy improvement strategy to ameliorate their output.

The second division of researches centered the attention on the relationship between trade and economic growth. The theoretical literature shows varied relationships between trade and economic growth. Firstly, there is evidence that trade stimulates economic growth through the transmission of technical Knowledge, the transfer of technology, the foreign direct investment and through the increase of economies of scale [19–21]. Secondly, there is evidence that economic growth boosts trade through the creation of a competitive advantage [22]. Thirdly, there is an absence of the relationship between trade and economic growth [23]. Fourthly, there is an existence of negative incidence of trade and economic growth [24].

On the empirical side, the literature shows mixed results in this area [22]. Four results are identified. First, trade positively affects economic growth [21,25–31]. In 12 African economies study, Onafowora and Owoye [27] find that there are significant effects of trade on economic growth. Using a data of 69 countries over the period 1986–1991, Greenaway et al. [28] find that higher trade will lead to more economic growth. Yanikkaya [29] confirms the hypothesis that growth increases if the trade increases by technology transfers, by scale economies and by the comparative advantage. In Malaysian study from 1970 to 2003, Chandran and Munusamy [30] suggest that trade contributes to enhance economic growth in the long time. In 75 countries study upon the epoch 1960–2003, Falvey et al. [31] suggest that trade enhances output in the long term. Eris and Ulasan [32] find that there is no evidence that trade affects positively economic growth. In Slovakia study over the period 2001–2010, Szkorupová [33] found that there is a positive action of trade (as measured by export) on economic growth.

Second, economic growth positively affects trade [21,34,35]. In Indian study from 1981 to 2010, Sahoo and al [35] prove the presence of causality moving from GDP to trade.

Third, trade and GDP are interconnected [21,26,36]. Harrison [26] found a positive connection between growth and different measures of openness in developing countries. The outcomes depend upon the types of specifications (cross-section or panel data) and on the time period. Also, the results demonstrate that there is feedback link among output and trade. By using cointegration, Granger causality tests, and the innovative accounting approach, Shahbaz [21] investigates the influence of trade openness on income in the long run. Shahbaz [21] find that trade boosts output. The outcomes demonstrate the emergence of bidirectional nexus across trade and gross domestic product. By employing yearly data in Croatia between 1994 and 2012, Dritsaki

and Stiakakis [36] find a bidirectional connection between exports and output in the short and the long run.

Fourth, trade and economic growth are not related [21,24,32,37,38]. By using data for 21 African countries over the period 1965–2008, Menyah and al. [37] find the absence of connection among trade and GDP. In 23 Asian countries study between 1950 and 2010, Trejos and Barboza [38] find that there is no evidence association between trade and economic growth. Fifth, trade negatively affects economic growth [24,34,39]. By using data for Japan and Korea for 1970–1997, Jin [24] found that trade has negative impacts on Korean economic growth and insignificant effects in Japan. In developing countries study Grennway et al. [39], prove the presence of negative connection among trade and GDP. In 82 countries study over the period 1960–2000, Chang et al. [34] find that effects of trade on economic growth is conditioned by the complementary reforms undertaken. These effects will be positive or negative.

The third strand of researches analyzes the relationship between trade and renewable energy consumption. Ben Aissa et al. [40] look into the link amongst GDP, trade, and renewable energy consumption by employing data of 11 African countries between 1980 and 2008. Within a long run analysis, the results reveal the presence of bidirectional links between GDP and trade variables and unidirectional relationship running from renewable energy and trade to GDP. In the short term analysis, the findings confirm the bidirectional relationship among trade and GDP and reject the possible association across GDP and renewable energy and between trade and renewable energy.

Sebri and Ben Salha [41] examined the links amongst trade, CO2 emissions, renewable energy and the gross domestic product in the example of BRICS countries between 1971 and 2010. The results accept the bidirectional hypothesis between renewable energy and output between trade and output and between trade and renewable energy. They illustrate that the importance of trade and economic growth to mature the renewable energy.

Ben Jebli and Ben Youssef [42] examine the linking between renewable energy, non-renewable energy, trade and economic growth in Tunisian study in the period going from 1980 to 2010. The results reveal the appearance of unidirectional nexus extending from the gross domestic product and trade to renewable energy. They propose that Tunisia should stimulate the employment of renewable energy, make a method for augmenting its advantage from renewable energy innovation exchange happening when importing capital products and achieve the establishment of renewable energy ventures oriented to export.

To the best of our knowledge, there is no article, attempting to comprehend the linkage amongst renewable energy, trade and GDP in developing and developed countries.

In the current study, we scan the nexus amongst GDP, renewable form of energy consumption, and openness in developed and developing countries. We employ a multivariate framework to study the linkage across renewable energy, trade and GDP for 72 countries during the epoch 1990–2012. Especially, we look into three following causality: (1) among GDP and renewable energy; (2) among trade and renewable category of energy; and (3) among GDP and trade.

Our article is divided into subsequent parts. Section 2 combines data and econometric method. Section 3 merges results and discussions. Section 4 amalgamates final conclusions and some policy implications.

2. Data and methodology

2.1. Methodology

The purpose of this specific research is to provide the links between renewable energy consumption (RW), trade (TD) and economic growth (GW) for the case of developing and developed countries.

To reach this objective, we start by considering the Cobb-Douglas production structure [40–44]:

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