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Environmental Kuznets Curve hypothesis and the role of globalization in selected African countries

Muhammad Shahbaz[a,1], Sakiru Adebola Solarin[b,*], Ilhan Ozturk[c,2]

[a] Energy Research Centre, COMSATS Institute of Information Technology, Lahore, Pakistan
[b] Faculty of Business, Multimedia University Malaysia, Room 5012, Melaka, Malaysia
[c] Faculty of Economics and Administrative Sciences, Cag University, 33800 Mersin, Turkey

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ABSTRACT

The present study incorporates globalization and energy intensity into the CO_2 emissions function and investigates the presence of Environmental Kuznets Curve (EKC) in 19 African countries for the time period of 1971–2012. We have applied the ARDL bounds testing approach for cointegration to examine the long run relationship in the variables. Our results confirmed the presence of cointegration between the series in Africa, Algeria, Angola, Cameroon, Congo Republic, Ghana, Kenya, Libya, Morocco, Nigeria, South Africa, Sudan, Tanzania, Togo, Tunisia, Zambia and Zimbabwe. The results indicated the positive effect of energy intensity on CO_2 emissions in Africa, Algeria, Angola, Cameroon, Congo Republic, Ghana, Kenya, Libya, Morocco, Nigeria, South Africa, Sudan, Togo, and Tunisia while energy intensity declines CO_2 emissions in the case of Zambia and Zimbabwe. Globalization decreases CO_2 emissions in Africa, Angola, Cameroon, Congo Republic, Egypt, Kenya, Libya, Tunisia and Zambia but increases CO_2 emissions in Ghana, Morocco, South Africa, Sudan and Tanzania. The EKC exists in Africa, Algeria, Cameroon, Congo Republic, Morocco, Tunisia and Zambia but U-shaped relationship is found between economic growth and CO_2 emissions in Sudan and Tanzania.

1. Introduction

The world is facing rapid climate change, which is attributed to increasing global warming and emission of greenhouse gases. Consequently, various aspects of environment, including the validity of Environmental Kuznets Curve (EKC) hypothesis have been placed under much scrutiny in the existing literature of environmental economics. The hypothesis has asserted that initially economic growth will lead to environmental degradation but eventually as income level increases, this degradation will decrease and a clean environment takes place in prosperous countries. However, there are still several aspects of the EKC hypothesis that have not received adequate attention. Arising from the recent advances in the econometrics sphere, the subject-matter has progressed with most papers using additional variables and concentrating on various sub-regions. One of the largely ignored variables in the existing literature is globalization. Without an adequate econometrics analysis, it is difficult to hypothesize the specific impact of globalization on emissions as it may reduce or exacerbate pollution. The first argument is that globalization is associated with human activities that breed pollution including industrial production, transportation and, more indirectly, deforestation. Globalization, which is partly synonymous with rising international trade, is partly linked to the growth of these three human activities (Huwart and Verdier, 2013). Globalization has allowed multinational corporations to relocate factories from high-income countries to low-income countries. These companies do not only pay lower wages than what it is expected in the home countries, but also do not often meet the environmental standards that are often imposed in high-income countries (Hubbard and O'Brien, 2013).

On other hand, it is also believed that globalization can reduce emissions level. The globalization of trade and research is associated with green technologies. Industry, global movements of capital, globalized research and innovation promote vector of "green growth" and are particularly effective instruments to fight pollution and climate change on a global scale. Globalization and

* Corresponding author. Tel.: +60 42523025.
E-mail addresses: shahbazmohd@live.com (M. Shahbaz), sasolarin@mmu.edu.my (S.A. Solarin), ilhanozturk@cag.edu.tr (I. Ozturk).
URL: http://www.ciitlahore.edu.pk (M. Shahbaz).
[1] Tel.: +92 334 3664 657; fax: +92 42 99203100; UAN: 0092-42-111-001-007.
[2] Tel.: +90 324 6514828; fax: +90 324 6514828.

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production network can help to foster new activities and new products and also new production processes (Huwart and Verdier, 2013). Globalized information and knowledge have made it possible for the public to be more aware of ecological issues and this has generated greater mobilization. Globalization can make environmental conservation compatible with economic development. This is because of international economic competition, which is mainly facilitated by globalization, helps in resolving many environmental problems as companies try to outwit each other in terms of abiding to environmental standards. Multinational corporations are precious allies in combating global warming, as they are knowledgeable about environmental standards and practices in developed countries and are vital vehicles for transferring green technology and good-practice (Huwart and Verdier, 2013). Therefore, pollution level moves to a horizontal line of maximum emissions as globalization forces a "race to the bottom" in environmental standards (Dasgupta et al., 2002).

Arguably, the least studied region in terms of EKC is African continent. This is largely due to the fact that the continent's fossil-fuel CO_2 emissions are low in relative terms. The total emissions in the continent was about 14%, 28% and 19% of the total carbon generated in North America, China and Europe in 2012. The emissions in the continent amount to 3.68% of the global carbon in the same year (Energy Information Administration, 2014). However, the pollution in some African countries is well ahead of some of their counterparts in Europe. For example, Egypt and Algeria generated 206 million metric tons of carbon (29th in the world) and 133 million metric tons of carbon (31st in the world), respectively in 2012. Greece and Austria generated 87 million metric tons of carbon (43rd in the world) and 67 million metric tons of carbon (or 52nd in the world), respectively in 2012 (Energy Information Administration, 2014). Emissions from all fuel sources are growing in the continent as total emissions for Africa has increased five-fold since 1960 and more than two-fold since 1980. The total emissions reached almost 1.2 billion metric tons of carbon in 2012 (World Bank, 2014; Energy Information Administration, 2014). South Africa, which accounted for almost 40% of the total emissions in the continent, has experienced increasing emissions level as it generated 473 million metric tons in 2012 compared to 235 million metric tons in 1980 (Energy Information Administration, 2014). Fossil-fuels accounted for more than 42% of the total emissions in the continent for the year of 2012 (Energy Information Administration, 2014).

The direct impact of the growing global emissions (inclusive of those generated in Africa) is climate change. Despite the fact that African countries have contributed the least to climate change caused by humans, there are widespread fears that Africa will be the worst hit. Floods, droughts and rising sea levels are just some of environmental impacts of climate change on Sub Saharan Africa. Climate change will have serious and adverse consequences for many development sectors in Africa, and threatens the economies and livelihoods of many African countries. The adverse impacts of climate change impose an additional cost on vulnerable countries to achieve their development goals. Reduced agricultural production, worsening food security, increased flooding and drought, spreading diseases and an increased risk of conflict over scarce land and water resources – which are all impact of climate change – will provide additional burden for African countries to achieve their developmental goals (Solarin, 2014a,b; Ibrahim and Law, 2015; Zaman et al., 2015; Zou et al., 2015).

The aim of this paper is to examine the EKC hypothesis in 19 selected African countries, while providing for energy intensity and a proxy for globalization. We focus on the African continent, which is not only largely understudied, but also the region that is most affected by the consequences of the growing global emissions. This paper contributes to the existing energy economics literature by five ways: (i), this paper examines the presence of the EKC using multi-country data set for African countries, (ii) globalization is added to the CO_2 emissions function to avoid specification bias, (iii) energy intensity is used instead of energy consumption to add a new dimension to CO_2 emissions function in Africa and capture technological advancement in production function, (iv) the bounds testing and combined cointegration approaches are used to examine the presence of cointegration between the variables, (v) short-and-long run impacts of economic growth, energy intensity and globalization are checked by applying ECM (error correction method) and OLS (ordinary least square) respectively.

The remainder of the paper is prepared as follows: Section 2 deals with a brief survey of papers on EKC. The model and data are discussed in Section 3, while the methodological framework is detailed in Section 4. The results are provided in Section 5, and Section 6 contains the conclusions and policy recommendations.

2. Literature review

The validity of EKC effect has been examined by a number of studies, which have utilized different econometrics methods and focused on different regions. Despite the lack of consensus among the results, the existing literature can be divided into two categories. The first fold examines the pollution – economic growth nexus for individual countries. The second strand examines the pollution – economic growth nexus for a cross-section and/or panel of countries (see Almulali et al., 2015, 2016). Due to the fact that we are conducting a multi-country study, our literature review will focus on the multi-country papers.[3] The literature is divided into two sections, with the first part concentrating on papers wherein the individual country's long-run and short-run estimates are not provided while the second part involves papers wherein the individual country's long run and short run estimates are provided.

The first set of the papers include Martıńez-Zarzoso and Bengochea-Morancho (2004) who examined the relationship between carbon dioxide emissions and real output in 22 OECD countries for the period, 1975–1998. Using the Pooled Mean Group (PMG) method, the authors were able to establish the existence of EKC in the countries. Apergis and Payne (2009) examined the relationship in CO_2 emissions, energy consumption, and output in six Central American countries for the period, 1971–2004. Using the Pedroni cointegration test and the Fully Modified Ordinary Least Square (FMOLS), the study supports the existence of EKC hypothesis in the Central American nations. In a similar study, Apergis and Payne (2010) explored the validity of EKC in 11 Commonwealth of Independent States for the period, 1992–2004. The study provided evidence for EKC hypothesis. Tamazian et al. (2009) examined the validity of EKC hypothesis in a panel of countries that include US, Japan, Brazil, Russia, India and China for the period, 1992–2004. The variables included in the model include real gross domestic product (GDP), energy consumption, oil consumption, industrial share in GDP, research and development expenditure, net energy imports, carbon dioxide emissions, financial development indicators and real output. With the use of random-effect method, the study was able to establish the existence of EKC hypothesis in the countries. Vollebergh et al. (2009) examined the relationship between income growth and pollutants emissions. Their analysis revealed a strong evidence of EKC hypothesis as SO_2 emissions is used as an indicator of pollution compared to CO_2 emissions. Using Bayesian approach, Musolesi et al. (2010) investigated the EKC hypothesis using the data of 109 countries of the globe. They found that EKC hypothesis exists in advanced countries but a positive

[3] We will ignore the causality aspect of these papers since it has little consequence on our paper.