

Do Globalization and Economic Development Promote Renewable Energy Use in Ghana?

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Abstract— The fight against global warming has been a global battle. Environmental sustainability and a sustainable economy have been a concern for many nations, government organizations, and non-government organizations. Therefore, it is highly recommended to investigate the factors that lead to carbon emissions and how the world could overcome them. This study uses GMM and FMOLS to analyze the contribution of globalization which is measured as foreign direct investment and trade openness, economic development, and population growth towards the use of renewable energy. The period under study is from 1990 to 2015. The result of the study indicates trade openness helps promote the use of renewable energy. A 1% increase in trade openness would raise renewable energy consumption by 39%. However, foreign direct investment does not motivate the use of renewable energy, and economic development does not add to renewable energy consumption. Population growth helps promote renewable energy usage. The government of Ghana has to restrict its environmental regulations to protect the environment from foreign investors.

I. INTRODUCTION

Global warming is one of the most argued environmental issues globally. It is recently believed that the high rising of carbon emissions globally is as the result of globalization and economic development. The international economy continues to experience a consistent rise in carbon emissions, making it problematic to attain the Paris agreement on climate change. Global warming-related to greenhouse gases (GHGs) and energy restrictions are the major threats to the international economy. The greatest contributor of the GHGs is carbon emissions, and it accounts for about 72 percent of the world's emitted GHGs. The World Health Organization 2015 report indicates that energy and fuel used in residential sectors account for 18% of global GHGs. The increase of GHGs global has put both human life and the environment in danger. 2017 was recorded as the year of natural disasters, which covers wildfire, drought, hurricanes, and heatwaves, and the international bodies

lost 31 billion dollars. As the result of poverty, dependency on climate for economic activities, and low technological know-how, Africa especially Sub Sahara Africa suffered seriously from the problem (Frimpong, Van Etten, Oosthuizen, Fannam Nunfam, & Studies, 2017).

The role of energy in economic development cannot be undermined. Energy consumption is having tremendous growth in developing countries as a result of industrialization, economic development, and population growth. Energy is seen to be the force behind economic development and is considered as one of the utmost relevant strategic commodities (Sahir & Qureshi, 2007). Energy has influence on pollution of the environment and sustain the environment as well. There has been a rising demand for energy due to globalization. The increase in demand for energy because of globalization has resulted in the search for sustainable energy since the most dependent energy is not sustainable. Fossil fuel is the most dependent energy in many countries, and the increase in energy

demand has resulted in the search for sustainable energy since fossil energy is not sustainable. Kraft and Kraft (1978) is the first study introduced when energy usage and economic development became a concern. The study indicated that economic growth causes the use of renewable energy in the U.S. (Kraft & Kraft, 1978). The result explains that economic development responds to energy used.

The relevance of energy in economic development is appreciated by many. The position of energy in developing and developed economies has caused a rise in demand for energy. The high demand for energy has further raised environmental concerns. Energy is argued as the main contributor of GHGs, which is considered as the main source of global warming. The option onboard is to reduce the usage of fossil fuel and substitute it with renewable energy. Ghana recently has been coupled with the implication of energy and fuel use and promoting environmental quality (Appiah, 2018). However, the fact about the initiative of reducing the use of fossil energy is mixed. The energy conservative policy carries the problem of hurting Ghana's economic development if proper policies are put in place, the other side is it would help reduce the rate of GHG emissions. Energy conservation without proper technological progress would negatively affect the economy (Odhiambo, 2009).

Many studies have supported the argument that renewable energy helps in sustaining the environment and promoting economic activities. Hu, Xie, Fang, and Zhang (2018) research on 25 developing countries to assess the effect of energy usage and carbon emissions from the period of 1996-2012, the result of the research indicates that renewable energy helps control carbon emissions. In addition to this, a study by Bhattacharya, Churchill, and Paramati (2017) on 85 developed and developing nations to assess the effect of renewable energy and carbon emissions indicates that, renewable energy influences carbon emissions reduction and promotes economic growth. Nevertheless, other studies do not appreciate the presence of renewable energy and argue that, both renewable energy and fossil energy influence carbon emissions in the long-term or it has no effect on carbon emissions. Al-Mulali, Saboori, and Ozturk (2015) research on Vietnam indicates that as a result of the low consumption of renewable energy in the country, it has no control on carbon emissions. Apergis, Payne, Menyah, and Wolde-Rufael (2010) based their study on 29 developing countries shows that as a result of a low level of technology, renewable energy influences carbon emissions in the nations understudy.

In the view of Adams and Acheampong (2019), 'the contradictions in the result might be influenced by regional income specific differences which are related to political institutions. However, factors that contribute to the use of renewable energy like foreign direct investment, financial development, and trade openness cannot be undermined. Economic development is not of the same level in every country. It differs from country to country, region to region, and continent to continent. These influence on renewable energy usage and effects on carbon emissions is very necessary to acknowledge.

Globalization in the sense of this study is the integration of the global economy through foreign direct investment and trade openness. The recent reduction in taxes and tariffs is as the result of globalization to foster the global economy and increase productivity. The view of the proglobalist indicates a positive effect of globalization on the environment, and the anti-globalist views otherwise. According to World Trade Organization 2018 report, foreign direct investment and trade openness liberation was enhanced from the late 1990s; however, after the 2008 economic crisis, there was a deceleration (Organization, 2018). Foreign direct investment has been recommended to be a key instrument in encouraging economic development and maintain environmental quality. These two advantages have influenced many advocates and analysts to provide for developing countries policy recommendations regarding foreign direct investments (Nsouli & Funke, 2003).

There are two world-recognized hypotheses that explain the relationship between globalization and the environment. The pollution haven hypothesis, which is the first one, explains that the polluting business in the global north relocate to the global south with flexible environmental regulation and at the long-term pollute the environment (Walter & Ugelow, 1979). These companies in the developed countries where environmental regulations are rigid relocate to developing countries where there is no rigid restriction on the environment and find it as the resting place for their pollution. The second is the pollution halo hypothesis which explains that, the host countries normally the global south enjoys positive benefits from trade and foreign direct investment since it is associated with technology transfer and efficient machines with low carbon emissions (Zarsky, 1999). It does not consider globalization as a threat but rather a blessing to the receiving country. The pollution halo further acknowledges the presence of foreign direct investment as environmentally friendly.

Basically, renewable energy like solar and hydro input on carbon emissions is very low as compared to

fossil energy. The international bodies and the concerned individuals are, therefore, encouraging the use of renewable energy as a means to replace fossil fuel to sustain the environment (Shahbaz, Nasreen, Ahmed, & Hammoudeh, 2017). Sub-Sahara Africa countries are endowed with a great abundance of renewable energy, and the investment into the project in renewable energy technologies is basically required for the expansion of their economies. Encouraging the development and the use of clean technologies is a good policy that would help to decrease GHGs to combat global warming (Apergis, Ben Jebli, & Ben Youssef, 2018).

An increase in energy accessibility and protection of the environment has introduced renewable energy development as the mainstream strategy (Hayford Isaac, Wei, & Justice, 2021). Policymakers have embraced the Sustainable Energy for All policy and have enacted the 2011 Renewable Energy Act as a means of supporting the initiative. In the view of Ankrah and Lin (2020), the development of renewable energy is necessary to ensure future energy sustainability and the factors that influenced the use of renewable energy are to be recognized. Renewable energy's impact on carbon emissions has dominated the world's concern due to the environmental pollution and global warming carbon emissions caused. Many studies have researched the effect renewable energy, economic growth, and fossil energy have on carbon emissions (Alkhathlan & Javid, 2013; Alshehry & Belloumi, 2015; Antonakakis, Chatziantoniou, & Filis, 2017; Awodumi & Adewuyi, 2019; Jahangir Alam, Ara Begum, Buysse, & Van Huylenbroeck, 2012). However, to the best of my knowledge and with serious literature review, no study has been done on whether globalization and economic development could help promote the use of renewable energy in Ghana. Renewable energy is seen as the best substitute for fossil energy which is dangerous to the environment. Therefore, in adding to the already existing literature on renewable energy, economic growth, and carbon emissions, this study investigates if globalization which is measured as foreign direct investment and trade openness and economic growth, could increase the demand and use of renewable energy in Ghana. Although (Acheampong, Adams, & Boateng, 2019) researched on globalization and renewable energy in Sub Sahara Africa but the focus was on the effect the variables have on carbon emissions. Nevertheless, this study focus on the effect of globalization on renewable energy. Since this study is the first research towards this direction, it would create awareness on either to appreciate the presence of globalization when the search of cleaner energy is a concern or not. The study would further

provide policy recommendations to policymakers when making policies related to the environment.

The debate for Ghana in respect to renewable energy is its abundance and how the country can develop to provide energy security and access (IRENA, 2015). Policymakers have shown solid commitment with the enacting of the Renewable Energy Act in 2011. This to scale up the use of renewable energy in Ghana, but still, the usage is not impressive. Although the policymakers have expressed their concern towards the use of renewable energy in Ghana by the enactment of the 2011 Act, however, the Act is too generic and short of a comprehensive implementation plan (Ashong, 2016). The Act provides provision for only two major policy measures, which are the Feed-In-Tariff and the Renewable Purchase Obligation. "The Feed-In-Tariff which generates pricing motivations for development and use of renewable energy resources; and the Renewable Purchase Obligation which orders electricity producers to place a compulsory percentage of Renewable Energy Source-Electricity on the grid or pay a determined premium" (Ashong, 2016).

From the figures (1, 2, 3), we could witness a fall in renewable energy usage in Ghana. The best achievement was in the year 1991, and the lowest achievement in the year 2015. This shows that the growth of Ghana's renewable energy usage has been falling, and the rise in some years is not strong enough. Figure 1 gives the relationship that has existed between renewable energy usage and foreign direct investment from 1990 to 2015. The figure shows that, in the years 1994 and 2000, an increase in foreign direct investment caused renewable energy to rise. In the year 2008, there was a sharp increase in both variables. However, renewable energy raised from a sharp fall in 2007. The relationship between the two variables is not constant and unpredictable. The two variables sometimes arise together, fall together, and mostly in the opposite direction.

Figure 2 shows that renewable energy usage and economic growth over the period have experienced opposite directional relationship. The economic growth has been quite constant while renewable energy usage continues to fall. In exception, both variables experienced a sharp fall in 2007 and a sharp rise in 2008, and a sharp fall again in 2009. Figure 3 gives the situation between renewable energy and trade openness from 1990 to 2015. The figure shows in the year 1997. Ghana attained the same point for both renewable energy and trade openness; however, trade openness was rising, and renewable energy usage was falling. Trade openness attained the highest score in the year 2000 and the lowest score in the year 1991. Renewable energy attained the highest score in the

year 1991, where trade openness attained its lowest score and the lowest score in the year 2015.

In the view of Ahmad et al. (2016), trade openness as part of globalization has contributed tremendously to economic development. From the mid-twentieth century, the international economy has massively improved with the credit to barrier-breaking to access the international market, transportation enhancement, international investment, intensive research, and improvement in technology. Energy consumed for the past decades reflects the global economic development today. Energy can be described as the "oxygen" that provides life to all economic activities. In the course for the global south to attain a high standard of living and sustainable economic development, the consumption of energy is at a higher rate. Nevertheless, global warming as the result of environmental pollution is associated with energy consumption (Alkhathlan & Javid, 2013).

The rest of the study has been structured as, section 2 provides the methodology, section 3 the results, section 4 the conclusion and policy recommendation

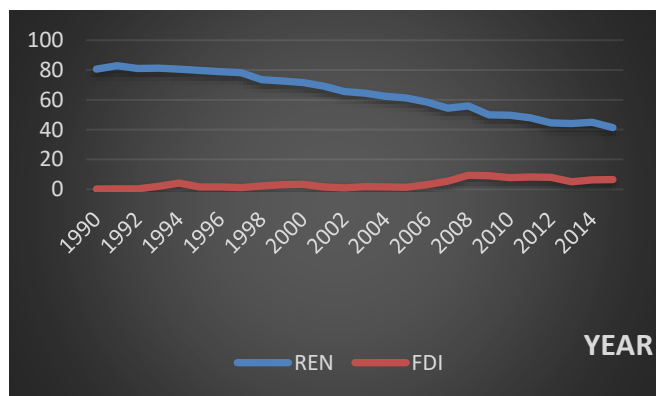


Fig. 1 Renewable energy consumption and FDI

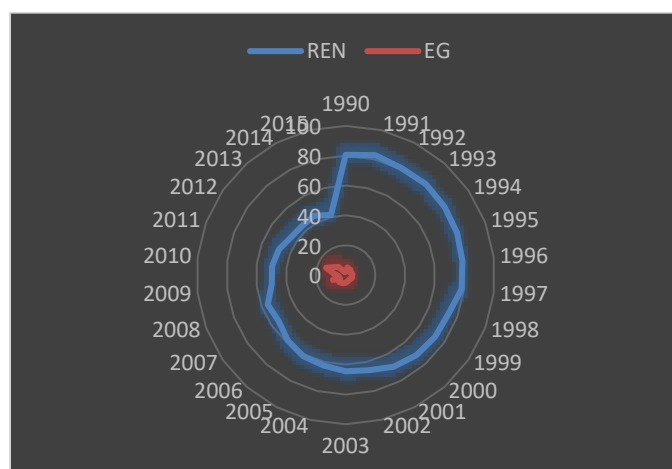


Fig. 2 Renewable energy and economic development

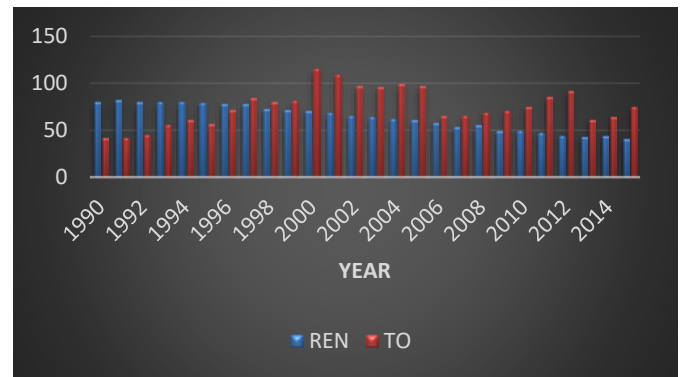


Fig. 3 Renewable energy usage and trade openness

II. METHODOLOGY

This research follows the empirical model of (Acheampong et al., 2019) and (Shahbaz, Balsalobre-Lorente, & Sinha, 2019) to analyze the effect of foreign direct investment, economic development, population growth, and trade openness on renewable energy. Renewable energy is represented as ($\ln ren$), foreign direct investment ($\ln fdi$), economic development ($\ln eg$), population growth ($\ln pg$), and trade openness ($\ln to$).

$$\ln ren_{it} = \alpha_1 + \alpha_2 \ln to_{it} + \alpha_3 \ln eg_{it} + \alpha_4 \ln pg_{it} + \alpha_5 \ln fdi_{it} + \varepsilon_{it}$$

Where $i = 1-26$, $t = \text{time}$ (1990 to 2015), $\alpha_1 - \alpha_5$ are the coefficient and ε is the error term.

2.1. Data

The data for this study is from the year 1990-2015 for Ghana, which was obtained from World Bank Indicators (WBI). The renewable energy consumption is measured as total renewable energy consumption without fossil fuel and represent the dependent variable, FDI is measured as foreign direct investment net inflows % of GDP, GDP is measured as annual GDP growth, trade openness is measured as total import and export activities % of GDP, and the population is measured as population growth annual percentage. Table 1 contains summary of description and statistics of the used variables

Table 1. Descriptive statistics

	$\ln ren$	$\ln eg$	$\ln pg$	$\ln to$	$\ln fdi$
mean	4.1418	1.6012	0.9334	4.2957	0.9106
median	4.1754	1.5371	0.9172	4.3010	0.9703
maximum	4.4180	2.6424	1.0633	4.7540	2.2478
minimum	3.7236	0.7785	0.8193	3.7492	-1.3811
Std. deviation	0.2293	0.3967	0.0702	0.2741	1.0438

III. RESULTS

Table 2 presents the correlational relationship that exists among the variables. Renewable energy usage has a strong positive correlation with population growth (0.7498). However, renewable energy has a negative correlation with the rest of the variables. It has a strong negative correlation with foreign direct investment (-0.7479) and a weak negative correlation with economic development and

trade openness (-0.3214, -0.2600), respectively. Foreign direct investment has a moderately strong negative correlation with population growth (-0.6299) and a weak positive correlation with trade openness (0.3682). Population growth has a moderately strong negative correlation with trade openness (-0.6919), and economic development has a weaker positive correlation with trade openness (0.1783).

Table 2. Correlation

	$\ln ren$	$\ln eg$	$\ln fdi$	$\ln pg$	$\ln to$
$\ln ren$	1				
$\ln eg$	-0.3214	1			
$\ln fdi$	-0.7479	0.3292	1		
$\ln pg$	0.7498	-0.1202	-0.6299	1	
$\ln to$	-0.2600	0.1783	0.3682	-0.6919	1

Table 3 presents the empirical result for GMM. The coefficients of all the estimated variables are in natural logarithms; therefore, its interpretation should be based on long-term elasticities. The result indicates that the presence of foreign direct investment, which is one of the globalization variables, does not influence the use of renewable energy in Ghana under the period of study. Foreign direct investment has a negative and significant influence on renewable energy usage. In another sense, if the presence of foreign direct investment does not promote the use of renewable energy, then it causes carbon emissions in Ghana. The result supports the pollution haven effect, which states that the presence of foreign direct investment caused environmental pollution in the receiving countries. This is as the result of flexible environmental regulations in the receiving countries, which makes foreign firms relocate with their high environmental unfriendly businesses to the receiving country. The result of this study is supported by (Salahuddina, Alam, Ozturk, & Sohag, 2017; Shahbaz et al., 2019), which had the same result in their analysis that,

foreign direct investment causes carbon emissions since it does not promote the use of renewable energy which is environmentally friendly. The other variable for globalization is trade openness, and the result indicates that trade openness promotes the use of renewable energy. The result shows that trade openness helps mitigate carbon emissions since it promotes the use of renewable energy. The increase in exports and imports helps enhance the use of renewable energy in Ghana. It provides the platform to import technologies needed for renewable energy usage and further improves economic activities, which provides a platform for renewable energy usage expansion. The result is supported by (Shahbaz, Hye, Tiwari, & Leitão, 2013), which provides proves to support the argument, trade openness mitigates carbon emissions. Research on Brazil indicated bidirectional causality among trade openness and the energies which was understudy. Meaning in the long-run, both trade openness and energies cause the increase of either other (Hdom & Fuinhas, 2020).

The result of the study further shows that population growth in Ghana causes the use of renewable

energy. Ghana, over the period of understudy, has experienced a fall in its population growth, and it has contributed positively to its renewable energy usage. This means population growth has a role to play in the transition from fossil fuel to renewable energy. The population has to be controlled to meet the energy available after the energy conservation policy. The result is in support of (Begum, Sohag, Abdullah, & Jaafar, 2014) that population growth helps mitigate carbon emissions. Ghana's population is controlled by family planning, and the use of contraceptives. Economic development in Ghana has no effect on renewable energy usage. The result indicates that, Ghana's economy has not grown enough to promote the use of renewable energy. There are other

studies that state that economic development causes carbon emissions (Malik et al., 2020; Ridzuan, Marwan, Khalid, Ali, & Tseng, 2020). However, it is not so for Ghana. Saidi and Hammami (2015) research on 58 countries indicated that, economic development has a significant and positive influence on energy. A study on Egypt indicated a bidirectional effect between renewable energy electricity and economic development (Ibrahiem, 2015). Research on India by (Ahmad et al., 2016) indicated a bidirectional relation between energy and economic development. According to (Appiah, 2018) research, it indicated that energy consumption influence economic development in Ghana but not vice versa.

Table 3. GMM

Variable	Coefficient	Std. Error	t-Statistic
$\ln eg$	-0.0984**	0.0486	-2.0245
$\ln to$	0.3908*	0.0799	4.8888
$\ln pg$	2.9906*	0.3487	8.5762
$\ln fdi$	-0.0568**	0.0261	-2.1733
R ²			0.800599
Adjusted R ²			0.762618
J-statistic			5.328139

3.1. Robustness Check

3.1.1. Alternative estimator

There is no problem of endogeneity when GMM is used for estimation. The GMM is capable of checking and controlling all the endogeneity and arbitrary heteroscedasticity in any unknown form (Baum, Schaffer, & Stillman, 2003). In other to certify the firmness of the

result, we used the FMOLS estimation technique, which the result has been presented on table 4. We used the FMOLS as part of the robust check. The results of the FMOLS did not contradict or overturn the result we got for IV-GMM regarding the signs and percentage-wise. The result of the GMM is the same for the FMOLS indicating that, there is no problem with the model used and its outcome.

Table 4. FMOLS

Variable	Coefficient	Std. Error	t-Statistic
$\ln eg$	-0.1450**	0.0652	-2.2256
$\ln to$	0.4995*	0.1278	3.9083
$\ln pg$	3.1031*	0.5809	5.3418
$\ln fdi$	-0.0815**	0.0332	-2.4543
R ²			0.8037
Adjusted R ²			0.7644
Sum squared resid			0.2454

IV. CONCLUSION AND POLICY RECOMMENDATION

4.1. Conclusion

Energy is considered as the "oxygen" for economic development. Every nation depends on energy for its economic prosperity and continuity. Therefore, it is very important to examine the factors that promote the use of renewable energy and make policy recommendations for the development of Ghana's economy. The study uses GMM to assess whether population growth, economic development, and globalization which is measured in foreign direct investment, and trade openness promote the use of renewable energy. The result of the study indicates that, foreign direct investment and economic development do not promote the use of renewable energy in Ghana. However, trade openness and population growth promote the consumption of renewable energy. To affirm the result, FMOLS was used as a robustness check, and the result from the FMOLS confirms the results from GMM. The signs and the percentages are all the same. In order to promote environmental and economic sustainability in Ghana, policy recommendations have been provided.

4.2. Policy recommendation

Based on our study, the result indicates that, trade openness promotes the use of renewable energy in Ghana. Therefore, the government should take advantage of the implication trade openness has on the environment to expand its market. The expansion of the market would facilitate the renewable energy usage increase and enhance economic development. Through importation and exportation, Ghana could benefit from technology transfer. In this respect, companies could import low carbon technologies to enable the reduction of carbon emissions, and companies could further import machines that could facilitate the use of renewable energy in production. The government of Ghana has to provide tax-free incentives to encourage companies to import renewable technologies and use renewable energy in their production. Population growth, according to our study result, promotes the use of renewable energy. Ghana, over the past decade, has experienced a fall in its population growth and its effect on the environment is good for environmental sustainability. Policies like the use of contraceptives and family planning have been working for Ghana, and the government should continue with education to enlighten the citizens on the need for population control.

Foreign direct investment does not motivate the use of renewable energy in Ghana. The result of our research indicates that, foreign direct investment has a negative effect on renewable energy usage. This might be as the result of flexible environmental regulations. The

government should pay more attention to environmental laws and restrict their regulation. Although, many nations depend on foreign direct investment for economic growth but we should not undermine its effect on the environment.

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