Karamoko Fadiga

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by

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The last words are now addressed to me
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Even whether you still have a long way to go
You should never stop on route
Keep believing in yourself
You will conquer the world

ETHICAL DECLARATION

I, Karamoko Fadiga, hereby, declare that I am the sole author of this thesis and it is my original work. I declare that I have followed ethical standards in collecting and analyzing the data and accurately reported the findings in this thesis. I have also properly credited and cited all the sources included in this work.

Karamoko Fadiga

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ABSTRACT

This study is investigated in order to contribute to the sustainable development by determining the effect of financial development and globalization in ECOWAS countries over the period 1990 – 2019. The research employed a quantitative methods apply to a panel regression model to investigate this research. The unbiased findings have reveal that globalization, population, financial development and GDP per capita contribute to environment damage meanwhile renewable energy consumption improve environment quality. Our findings indicate that the answer to the investigation is that financial development and globalization have a bad effect on environment in the ECOWAS region.

Keywords: Financial development, globalization, carbon dioxide emission, sustainable development, ECOWAS

ÖZ

Bu tez, 1990 - 2019 döneminde ECOWAS ülkelerinde finansal gelişme ve küreselleşmenin etkisini belirleyerek sürdürülebilir kalkınmaya katkıda bulunmak amacıyla araştırılmıştır. Araştırmada bir panel regresyon modeline uygulanan nicel yöntemler kullanmıştır. Bulgular, küreselleşme, nüfus, finansal kalkınma ve kişi başına düşen GSYH'nin çevreye verilen zarara katkıda bulunduğunu, yenilenebilir enerji tüketiminin ise çevre kalitesini artırdığını ortaya koymuştur. Bulgular, araştırmanın cevabının finansal kalkınma ve küreselleşmenin ECOWAS bölgesinde çevre üzerinde kötü bir etkiye sahip olduğunu göstermektedir.

Anahtar Kelimeler: Finansal kalkınma, küreselleşme, karbondioksit emisyonu, sürdürülebilir kalkınma, ECOWAS

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2SLS	Two-Stage of Least Squares
APE	Agreement of an Economic Partnership
ARDL	Autoregressive Distributed Lag Model
BCEAO	Bank Central des Etats de l'Afrique de l'Ouest
CCR	Canonical Cointegration Regressions
CFAO	Corporation For Africa Overseas
CO2	Carbon Dioxide
DOLS	Dynamic Ordinary Least Square
ECOWAS	Economic Community of West African States
EKC	Ecological Kuznets Curve
FCFA	Franc de la Communauté Française d'Afrique
FD	Financial Development
FDI	Foreign Direct Investment
FE	Forecast Evaluation
FMOLS	Fully Modified Ordinary Least Square
GDP	Gross Domestic Product
GLO	Globalization
GMMG	Generalized Method of Moments
IPS	IPS Unit Root Test
K	Capital factor
KOF	The KOF Index of Globalization

L	Labor Factor
LCI	Lower Confidence Interval
LCO2	Log Carbon Dioxide
LFD	Log Financial Development
LGDP	Log Gross Domestic Product
LGLO	Log Globalization
LLC	LLC Unit Root Test
LMDI	Logarithmic Mean Divisia Index
LPOP	Log population
LRE	Log Renewable Energy
OLS	Ordinary Least Square
POP	Population
PVAR	Panel Vector Auto Regression
RE	Renewable Energy
RE	Regular Expression
UN	United Nation
VECM	Vector Error Correction Models
WAEMU	West African Economic and Monetary Union
WDI	World Development Indicator

CHAPTER 1
INTRODUCTION

1.1 Problem Statement

The problem statement of the study is to determine the type of contribution financial development and globalization have on environment.

As financial development is an economic growth provider and globalization lets spread information, goods and services across the world. The two of them combined should have contribute ecologically to environment quality. As financial development by providing economic growth, could make rise enterprises having good externalities by ameliorating citizen life meanwhile globalization will let those good externalities get spread by facilitating the expansion of the firms having good externalities over the world. However, the fact is opposite, financial development by providing accessible fund to people either industries maintains the capital intensive goods in the rise which increase environmental degradation through the production procedure, meanwhile globalization by letting those pollutant industries get expand by letting them to implement more subsidiaries across the world will cause an augmentation of environment pollution.

Regarding the shared opinions and evidences from the literature, it important to conduct a study to determine what could be the evident impact of financial development and globalization in the ECOWAS countries.

1.2 Purpose of the Study

The investigation of the study aims at the contribution of these points:

First of all, this study is conducted in the purpose to contribute and promote the sustainable development as it will be a manner to point out the environmental effect of globalization and financial development in the ECOWAS region.

The study will be profitable to financial institutions in order to aware them about their ecological contribution to environment

It is also a way to call on financial institutions to be regarding at the economic activities they may provide their support and also endeavour to prioritize project with ecological contribution.

1.3 Significance of the Study

This study is significant because it is first a contribution to sustainable development goals of the sustainable development as the climate change is becoming more a worldwide concern. It secondly reveals the evidence of the ecological print of globalization and financial development. Thirdly is it an update of the literature about the topic.

The originality of my work is the area where the study is conducted. In opposite to the others studies mentioned in the literature, my work will be exploring a new space which is the ECOWAS area.

1.4 Research Questions and Hypotheses

The research question has been stated has follow: what are the effects of financial development and globalizations in the ECOWAS countries?

1.5 Assumptions

The secondary data used is assume to be reliable enough to conducted this study

1.6 Limitations

The limitations that could be highlight for this study is the missing of availability of data for some countries included in the study because of that some variable could not be taken into account for the study (mostly variable related to growth, energy consumption, industrialization). Also the incompatibility between some variables and the chosen model of the study have to be mention. Those reasons are in somehow the limitations in the study as the missing in data and the incompatibility with model caused the decline to utilize some variables.

CHAPTER 2
LITERATURE REVIEW

2.1. Financial Development and Carbon Dioxide

The first researches to find an empirical relationship between financial development and environment were (Aufderheide & Rich, 1988); (Schmidheiny & Zorraquin, 1998). They shared they opinion about the World Bank financial assistantship process saying that it provides accessible loans funds by ignoring the kind of impact it could have on environment. The relationship between financial development and carbon dioxide emissions is not nowadays concern as many researchers namely Wang, Wang, Li, Fang and Feng (2019); Jun, Zakaria, Shahzad and Mahmood (2018); Chtioui (2012); Gökmenoğlu and Sadegheih (2019) came up with the fact that financial development has an impact on carbon dioxide emissions, they went furthermore supporting the argument that the impact of financial development is both indirect and direct. The relationship between the both does not stop only to the indirect and direct relationship because the nexus between financial development and carbon dioxide emissions has created two group of people or researchers. On the one hand a group attributing a positive impact to financial development as one of the fuel of environment degradation. They support that financial development as a stimulant of the economic growth causes the increase in energy demand, Giannetti, Almeida and Bonilla (2010); Gunasekaran, Jabbour and Jabbour (2014).

Farhani, Chaibi and Rault (2014); Ito (2017) also defend that financial development increase carbon dioxide emission through economy growth and he also specified the process by which it does. According to him, when the stock market of a country is in the rise, the local businesses have easily access to loans to increase their activities by purchasing machineries or investing in others projects what increases the CO2 emission more than before. That is the first evidence proven, the second evidence proven defends that the more an economy is financially developed the more it attracts foreign direct investment (FDI), which means more enterprises, hence more production so more CO2 emission.

Wang et al. (2019) have shown that is not only producer (firms) that produce CO2 but everyone has his responsible part in the environment deterioration because even consumer produce CO2 and the process is as same as Farhani et al. (2014), Ito (2017) described. First consumers have easy access to loans then they increase the demand from companies (firms will produce more) and now they will buy some items that also produce CO2, items like: air conditioners, refrigerators, cars, oven, and washing machines. The technological aspect of life is said to be at the origin of household CO2 emissions as the world is modernizing in going. Those authors previously quoted are not the only one supporting the ideology of financial development contributing to increase carbon dioxide emission, even Al-Mulali, Ozturk and Lean (2015) came up with the fact that financial development could rise up CO2 emission in the long-run.

Shahbaz, Shahzad, Ahmad and Alam (2016) by examining the asymmetric impact of financial development on carbon emission in Pakistan found a unidirectional causality and through positive shocks the banking sector of financial development could rise up carbon emission. He is not the only one to find a unidirectional causality between both as Lu (2018) found the same thing by conducting his research in 12 countries. Salahuddin, Alam, Ozturk and Sohag (2018) proved in their study conducted in Kuwait that financial development increases CO2 emission. It seems like gradually we are progressing the world and the studies, the authors agree that financial development is at the root of carbon emission but it does not hold another group of authors on the other hand who thing contradictory to all of what have been said and the opinion they defend is that financial development helps reduce the carbon emission. That is the case of Tang and tan (2015); Tamazian, Chousa and Vadlamannati (2009); Samreen and Majeed (2020) they came up in their studies that financial development fosters environment quality because an increase in financial development provides a diminishing in asymmetries of information (everyone has access to information) and it also provides a rise in the innovation and expand technology which permits scientist to find some new resolutions to reduce environment deterioration, to make it short, they just think science advancement supported by financial development lets set some new modern and easier method to deal with environment degradation.

Moghadam and Lotfalipour (2014) just made it short by saying every good banking sector or capital market make the promotion of technological development which is the basement of environmental improvement. If all of the papers do agree so far and bet on the technological advance to be the saver of environment by reducing carbon emission, Ameer, Amin and Xu (2022) think differently. They said that carbon emission increase because financial institutions do not have environment policies. We should get this as; financial institution could diminish CO2 whether they start being concern by the environment quality first and then implement some 'environment saving chart' that could be apply to anyone borrowing money from them. Thereby those financial funds would be use with efficacy, efficiently and also ecologically. Atsu, Adams and Adjei (2021) also agree that financial development whittle carbon emission, so they suggest financial institution to render credit more accessible to everyone and also suggest to promote investment in environmental activities (ecological activities) and actions. Even Turkey has not skipped to this study as it is an industrialized country, Rjoub, Odugbesan, Adebayo and Wong (2021) have proved that environmental sustainability could be promote by financial development, (Vo & Zaman, 2020) by conducting a cross countries study across 101 countries have also shown that financial development makes go down carbon emission.

The literature has revealed that the opinions are shared about the impact of financial development as we can perceive different perspectives about its environmental contribution.

2.2. Globalization and Carbon Emission

Globalization defined as channel of interaction of many populations by exchanging culture, values, ideas or even good and services, it is seen as the way through which many people around the world belonging to different cultures, identity or civilization come together and make the world a single culture.

Fischer (2003) thinks that globalization is a way of maintaining higher the economic interdependence among countries by first increasing the trade out-boundaries even neighborhood and also the augmentation of financial flows and labor flows. Groomsman and Krueger (1991) defined it their way as the take-off of trade's barriers and

the expansion of economy and its activities while promoting trade. The literature of globalization linked to carbon emission has reveal mixed evidences.

First as clear as globalization fosters economic activities; those authors: Solarin, Al-Mulali and Sahu (2017) conducting research in Malaysia, Haseeb, Xia, Baloch and Abbas (2018) conducting research in BRICS countries, Shahbaz et al. (2018) conducting research in Japan even Majeed and Mazhar (2019) using a cross-country study of 155 countries came up with the fact that globalization has a negative effect on environmental quality because globalization permits people around the world to have facilely access to goods and services at a competitive price so the demand for those goods and services are always in the rice and in order to increase the production, firms over-exploit the resources and this will augment pollution. The trade aspect has been also addressed by saying that moving the good and services around the world requires the use of fossil fuel so the transportation leads to the waste or rise of fossil fuel usage which provoke air pollution but also the diminishing or almost the extinction of the natural resources.

In contrast to the negative contribution of globalization on environment quality those authors: You and Lu (2018); Mishkin (2009); Phong, Van and Bao (2018); Antweiler, Copeland and Taylor (2001); come up with the fact that globalization has a positive effect on environment degradation. They say globalization lets generalize technology to the world, it spread innovation from a place to an another one, diminish the usage of fossil fuel and augment the usage of renewable energy therefore reduces CO2 emission. This is not the only way that it impacts environment positively it also rises the foreign direct investment (FDI) in the countries which (FDI) helps support technological advance and scientists researches to make grow greener atmosphere. Jebli, Youssef and Ozturk (2016) by examining the link between economic globalization and financial development conducted in the North America have shown that globalization impacts negatively CO2 emissions.

2.3. Economic Growth and CO2 Emission

In the literature so far, from all the variables related to carbon dioxide emission study, economic growth is the most pointed out and who comes over repeatedly as the biggest sources of carbon dioxide emission. Indeed, who says economic growth says

economy of scale hence says production and consumption and we all know that production requires some raw materials which are sometime natural resources, and not to limit there, the production produces as well some output that are not always usable (the garbage of production or chemical products) which are sometime dropped in nature (environment; ocean; in the air) which causes environmental quality deterioration hence the term negative externalities (Pigou, 1920).

As we know that economic growth is a gradual increase in the GDP, which is another way mean too, to obtain increase in the production, thereby an interrogation that stroke on people mind about this is: how long could environment still support the effect of economic growth if really it has an impact on it?

It sure that the economic growth impacts of the environment quality; but from the least that we can see the first impact pointed out is a negative impact as industries are its result and we all know how industries are pollutants. But another stand of people would like to know if it has no others impact except the pollutant one given to him. It is in this purpose that some authors endeavoured themselves to give a highlight to these. Simon Kuznets (1955) by answering, has developed the environmental Kuznets curve (EKC). In the environmental Kuznets curve, Kuznets (1955) presents the relationship between environmental quality and economic growth as an inverted U-sharp (∩) because he strongly defends that in the short-run environmental degradation is spread by economic growth but when it comes to the long-run economic growth mitigates environmental degradation, after reaching a level of growth's threshold. This reveal of Kuznets (1955) seems be true because Aspergis (2016) by conducting a research in 15 countries has discovered that economic growth rise and decrease CO_2 emission from countries to another country but the most of them were presenting the environmental Kuznets curve evidence, what means CO2 is raised at first time then reduce in the long run. Analyzing the same topic through Egypt, Brazil, China, Nigeria, South Korea, Japan and Mexico even South Africa, (Onafowora & Owoye, 2014) have also come to the end of their study with the presence of EKC in the two of the countries: South Korea and Japan. They also came up with a new structure of carbon emission shape which is, N-shape giving thereby a new expansion to the inverted U-shape. Even if the U-shape of environmental Kuznets curve (EKC) has been approved by some authors it does not stop some others like

(Adewuyi & Awodemi, 2017); (Holtz-Eakin & Selden, 1995); (Fodha & Zaghdoud, 2010); (Farhani & Ozturk, 2014) to be disagreeing with the concept by saying that an economic growth does not always render better the environmental quality just because they defend that as long as economy grows as long as CO2 emission will ride the same path which means that environmental degradation rises alongside of economic growth. When it comes to assess the causality relationship between environment betterment and economic growth, also there, findings are varying and the research methodologies are varying too. Al-Mulali, Ozturk and Solarin (2016) by investigating the research about the causal relationship among carbon dioxide emission, energy consumption and economic growth in the Caribbean countries of the America continent ended up by the result that 60% of those countries hold a bi-directional relationship between those variables in the long run. Oppositely to this finding of Al-Mulali et al. (2016), Omri (2013) has rather found both unidirectional and bi-directional relationship as follow: he has found a bi-directional relationship between economic growth and energy consumption while the causality between carbon emission and energy consumption reveal a unidirectional relationship. They are not the only to come to something like this while conducting this research even Zhang and Cheng (2009) have arrived at the end of their study to detect a unidirectional ganger relationship of causality in the long run while conducting study in China.

2.4. Urbanization / Population and CO2 Emission

15 November 2022, the United Nation (UN) has officially announced that we are now 8 billion of humans living on earth and it also precise that it has taken 12 years to get earth's population from 7 billion to 8 billion. It also has been reminded that the population was raise to 6.1 billion in the year 2000, what to make us realize that in just 22 years the world's population has grown of 1.9 billion of humans being. A thing to be sure about is that the more population grows the more production and consumption increase and the more our cities get expand, so the more urbanize the countryside gets. Chtioui (2012); Pata (2018); Salahuddin, Gow, Ali, Hossain, Al-Azami, Akbar and Gedikli (2019) by conducting a study about the relationship between urbanization and CO2 have come up with the evidence that urbanization impacts both positively and negatively the environment. Moreover, an inverse relationship has been found between urbanization and

CO2 by Kanase-Patil, Saini and Sharma (2011) while running a study in 69 countries by using a panel data. Özataç, Gökmenoğlu and Taspinar (2017) by studying the relationship between urbanization, energy per capita, trade openness and consumption ended up by confirmed a positive relationship between carbon emission (per capita) and urbanization. Bong, Lim, Klemeš, Ho and Ho (2018) revealed an inverted U-shape relationship while conducting a study about the relationship between urbanization and carbon emission. Adams and Klobodu (2018) by conducting a study in 26 African countries about the relationship between carbon emission, financial development, GDP and urbanization by using a chow test, GMMG and cross-country methodology found that urbanization increases the carbon dioxide emission with no presence of EKC existence. Oppositely to the finding of Adams and Klobudu (2018); Majeed and Luni (2019) also found that urbanization increase carbon dioxide by this time with the presence of EKC which means urbanization increases carbon emission in the short run but will be mitigating the emission in the long run. It is also good to precise that Majeed and Luni (2019) used pooled OLS, 2SLS, Hausman, FE and RE methodology. Kasman and Duman (2015) conducted a study over the period of time 1992 - 2010 for new European Union member. Examining the linkage between urbanization; real output, gas emission, energy consumption and trade; he ended up with a finding supporting the EKC hypothesis existence in those countries. By a fully modified least squares, (FMOLS) regression, he has shown that urbanization and trade openness impacts positively carbon emission. In addition, he presented the causality between urbanization to CO2 emission as a one-way causality. Hossain (2011) analyzing the same relationship between the same variables (trade, energy consumption, gas emission and real output) but this time for newly industrialized countries between the years 1971– 2007, found a causality relationship between the variables in the long run but has found a unidirectional causality in the short run. Sharma (2011) with his study covering the period 1985– 2005 conducted in 69 countries and analyzing the relationship between GDP, trade openness, urbanization, energy consumption and environmental deterioration found that urbanization generates environment quality whittle down carbon emission while output per capita energy consumption and trade openness drive to environment degradation.

Al-Mulali et al. (2015) have conducted a study in 129 countries by diving them in 4 groups: high-income countries, upper middle-income countries, lower middle income countries and low-income countries using the dynamic ordinary least square (DOLS) in the purpose to analyze the relationship between real output, urbanization, CO2, trade openness and energy consumption. The results have reveal that a negative impact of urbanization on carbon dioxide emission in three of the group. Farhani and Ozturk (2015) conducted their study in Tunisia in the purpose of investigating the linkage between urbanization, gas emission and some others variables. The result obtained while going through an ARDL approach shown that urbanization and all the variables taken into account for the study lead to the degradation of environment and the evidence of no EKC hypothesis in Tunisia has been proved. It has been also shown from ganger causality that urbanization has no causality on environment in the long run. Zhu and Peng (2012) while investigating his study in China about the impact that population changes has on CO2 emission said that studying the linkage between population and carbon dioxide emission requires an approach of two categories: the first one is the study of the kind of interaction (causality and mechanisms) population and carbon emission have and then the second one is the evaluation of the quantitative impact that population plays in carbon dioxide emission. Chen and Zhu (2011) have found while using a kaya identity equation and investigating the province in China called Fuijan that the population growth contributes in the emission of carbon dioxide.

Satterthwaite (2009) while investigating in different countries the carbon emission level has noticed as finding that if population growth is pointed out as carbon emitter it should not matter, because the matter is not the population size but what matters is the consumption level of the urban population as to say we should categorize the population in two: the urban population and the countryside population. It is also a way of affirming that the countryside populations are less pollutant than the urban one and they are more ecologic and even environmental concerned rather than the urban one. Knapp and Mookerjee (1996) through a ganger causality test investigated the linkage between the population growths and found the population growth whittles down the carbon emission. The studies of Cole and Neumayer (2004); Shi (2003); Fan, Liu, Wu and Wei (2006); Jiang, Wang, Ying, Zhong, Cai and He (2006); York, Rosa and Dietz (2002) by making

an age discrimination in the population (aged between 15 – 64) designated as the working population age range have revealed that this age range population are the most carbon emitter than the others age range. Cole and Neumayer (2004) in the purpose of pushing the study a little bit further has taken into account in plus of this working population, the population under 15 years old and the finding has shown that this younger population has is not statistically significant in producing carbon dioxide. But oppositely to the idea of Cole and Neumayer (2004), those authors: Zhu and Peng (2012); Tobias and Heinz (2012) have incorporated aging population in their studies and they ended up with the evidence that this makes go up carbon emission level. In addition, Dalton, O'Neill, Prskawetz, Jiang and Pitkin (2008) have a result completely opposite to those of the group of authors above; what means all human emits CO2 whatever age they could be. But, O'Neill and Chen (2002) do not agree with Dalton et al. (2008) because they think that adult upper than 65 age old are more independent in their daily actions so they generate more carbon by using (heater, light, AC, fridge, stove, car, plane, and so on) and we have to recall that sometime adults live alone before getting married and having child, so they are first CO2 emitter and when they have children, those one (population aged under 15) just does a marginal emission of the whole household's carbon emission. We Guo, Deng and Guan (2004) in their investigation about the effect that the population structure in China could have on CO2 emission decided to run this study in 30 provinces of China using the logarithmic mean divide index (LMDI) have come up too many evidences like result but one of the most important is that, there is no significant impact on carbon emission when it happens a change in the population sex structure. For their study they have taken into account the gender part in the population categorizing.

2.5. Renewable Energy / Energy Consumption and CO2

The linkage between energy consumption, renewable energy and carbon emission is not a recent issue addressed in the literature. Many articles have investigated this dimension whatever the study could be (cross-country studies, single countries studies) and so on. Van Hoang, Shahzad and Czudaj (2020) have tried to investigate a double impact of consumption of renewable energy on both CO2 emission and economic growth

at the same time. Renewable energy has been pointed out in the studies of Sarkodie and Adams (2018); Tit, Said, Mahmoud, Kouser and Yamani (2019) as carbon emission reducer. A study conducted by Charfeddine and Kahia (2019) in the purpose of analyze the causality between renewable energy, financial development and carbon emission in 24 countries using a panel vector autoregressive (PVAR) model has shown that the both of the independent variables are significant. Using an ARDL and ganger causality test methodology while conducting research in Tunisia; Jebli and Bellouni (2017) come up with the final result that in the long run an increase of the GDP provokes a renewable energy and energy consumption wasting which will make go up the level of carbon emission. Majeed and Luni (2019) proven in their study that energy consumption is at the root of environment degradation in a multiple way: first of all because energy humans consume are made of fossil fuel and the production generates an emission of carbon dioxide and even a deterioration of natural water resources and land. Many studies in the literature namely: Farhani and Ozturk (2015) study conducted in Sri Lanka; Paramati, Alam and Chen (2017) study conducted in Pakistan; Phong et al. (2018) study conducted in Vietnam have similarly found the result that CO2 emission gets higher when energy consumption increase too, hence degrades environment. Running a study using the VECM, FMOLS and LCI methodology have shown that energy consumption does not affect energy CO_2 with evidence of the existence of EKC hypothesis, Nasreen and Anwar (2015).

Going through articles about all the dimension addressed above has shown that the literature is varies about the topic and also that either old or recent papers, single or cross-countries studies, panel studies or whatever methodologies or data used to conduct the studies, the opinions of the impact of financial development, globalization, economic growth, population and renewable energy kept being shared so far, agreeing or disagreeing with each other, what can be keep in mind is that they all belong one of the two big groups:

On the one hand a group who attribute a positive aspect to financial development, globalization, economic growth, population and renewable energy and on the other hand another group attributing and negative aspect to the same variables. It also possible to come across a third group, smaller that the two others, a little bit uncertain about which position to take but those one strongly support that even if those variables are benefit to

CO2 diminishing (advantages) they have also some drawbacks on the ecology and vice versa. Having a contradictory point of view, evidences, findings do no means we should prove wrong to the idea going against our but it is the opportunity to show that no everyone is in the same boat.

2.6. ECOWAS

Economic Community of West Africa States in short ECOWAS came in life in 1975 precisely on 28 may through the Lagos' treaty. The aim of its creation was in the purpose to instigate economic integration through the countries members. At the begınnıng, fifteen countries were member at the date of creation then they became sixteen in 1977 because Cabo Verde had joined the community two years after that it came alive. Unpredictable, but it became a fact in 2017, the Mauritania, a member of the Community has decided to leave, leaving the community members at the number of fifteen as at its date of creation. It seems that Mauritania did not take long to change its mind and realize the benefit of the membership to ECOWAS because three years later precisely in 2020 it has requested a procedure to be counted in back, in the ECOWAS' members but it was a failure. Same for Morocco who attempted also to join the community in 2020 but it has been also a failure. Thereby nowadays the ECOWAS counts precisely fifteen countries whom are: Benin, Burkina Faso, Cabo Verde, Cote D'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. If all those countries came together in 1975 and made one through ECOWAS, it is important to notice that they have some differences at the language level and at their economic level. Three languages are spoken into the ECOWAS region mainly French for most of the countries (Benin, Burkina Faso, Cote D'Ivoire, Gambia, Guinea, Mali, Niger, Senegal and Togo); English for four of them (Ghana, Nigeria, Liberia, and Sierra Leone) and at last Portuguese spoken in just two countries (Cabo Verde and Guinea-Bissau).

The overall population of ECOWAS has been recently estimated at 345 million of people. ECOWAS also has as main goal the peacekeeping in the region because in case of peace distortion, they should join their army force together to bring the rest back. This has also been the case in Cote D'Ivoire during the coup d'état in 2002 and also in Mali in 2013. When it comes to the currency of the countries, several currencies are used within the ECOWAS area but the most spread currency is name FCFA this currency is used by

eight countries over the fifteen. The meaning of this acronym FCFA given in English could be (currency of African's financial community). The countries user of the FCFA are (Benin, Burkina Faso, Cote D'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo) and those countries all together belong to another partnership called WAEMU and the meaning of the acronym is West African Economic and Monetary Union. The central bank, emitter of the FCFA is called BCEAO, based in Senegal precisely in Dakar the capital of the country, it is the only one in charge of money creation and economic policies control for all of the eight countries.

At last, the others are single currency user and have their own central bank within their countries. Those currencies for each country are: the CEDI uses in Ghana; NAIRA uses in Nigeria; LEONE uses in Sierra Leone; ESCUDO uses in Cabo Verde; ''DALASI'' uses in Gambia; LIBERIAN DOLLAR uses in Liberia.

CHAPTER 3

METHODS

3.1. Data

This study, to examine the effects of financial development and economic globalization will be considering both cross-country and time variation in the data. The sample will be covering 15 countries (Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone and then Togo) all belonging to ECOWAS (Economic community of West Africa States). The data will be employing yearly data from the period of 1990 to 2019. The data have been taken from two sources mainly: The World Bank website and KOF Globalization Index prepared by Swiss Economic Institute (Dreher, 2006). The variable collected for the study are the following:

CO2, dependent variable of the study, representing the carbon dioxide emission metric ton per capita, it is use the purpose to measure environment degradation. The others variables are the independent one and those are: GDP per capita (current USD $); FD stands for financial development index; GLO is for globalization index; RE is the renewable energy consumption (% of total final energy consumption) then POP for population estimated in number.

Carbon dioxide has been used in the study has the environmental degradation measurement because most of the articles in the literature were using it as environmental degradation measurement (Tahir, Luni, Majeed & Zafar, 2020); Charfeddine and Ben Khediri (2016) and also going through data, it has been realized that carbon dioxide will be a variable that could be easier managed in the purpose of the study.

Table 1

Definition and sources of variables

Variable	Notation	Measurement	Data sources
Carbon dioxide (per capita)	CO_2	CO_2 emissions (metric tons per capita)	WDI, World Bank

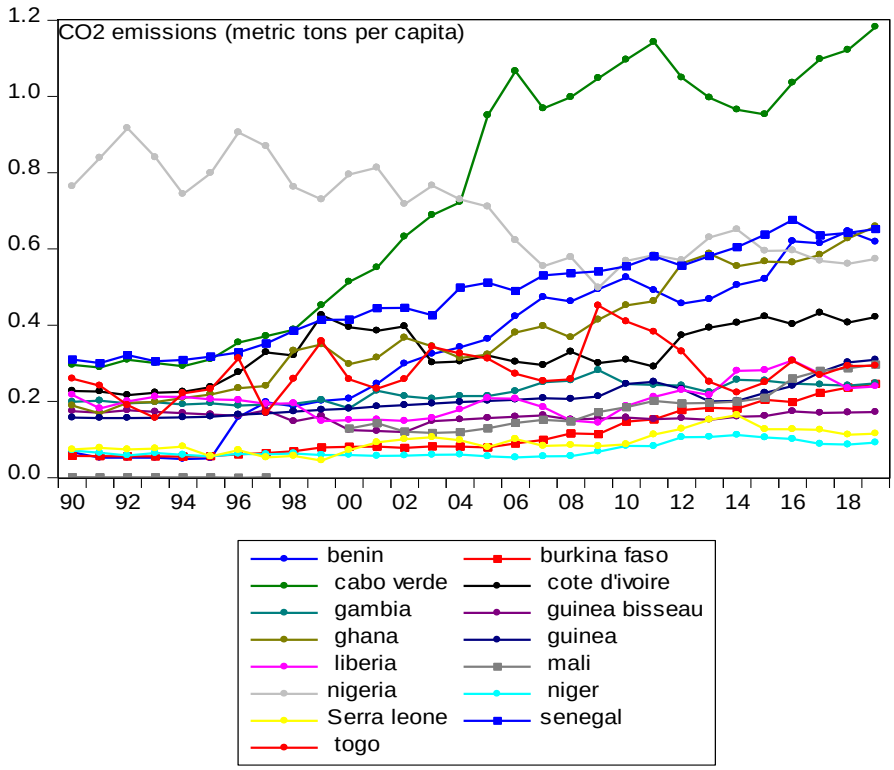
Table 1 (*continued*)

Financial development	FD	Financial development index	WDI,World Bank
GDP (per capita)	GDP	GDP per capita (current US$)	WDI, World Bank
Globalization	GLO	Globalization index, de facto	KOF index (Dreher 2006)
Population	POP	(% of total population)	WDI, World Bank
Renewable energy	RE	Renewable energy consumption (% of total final energy consumption)	WDI, World Bank

In order to take a look at the trend of the variables for each of the country. The graphs are given below:

Figure 1

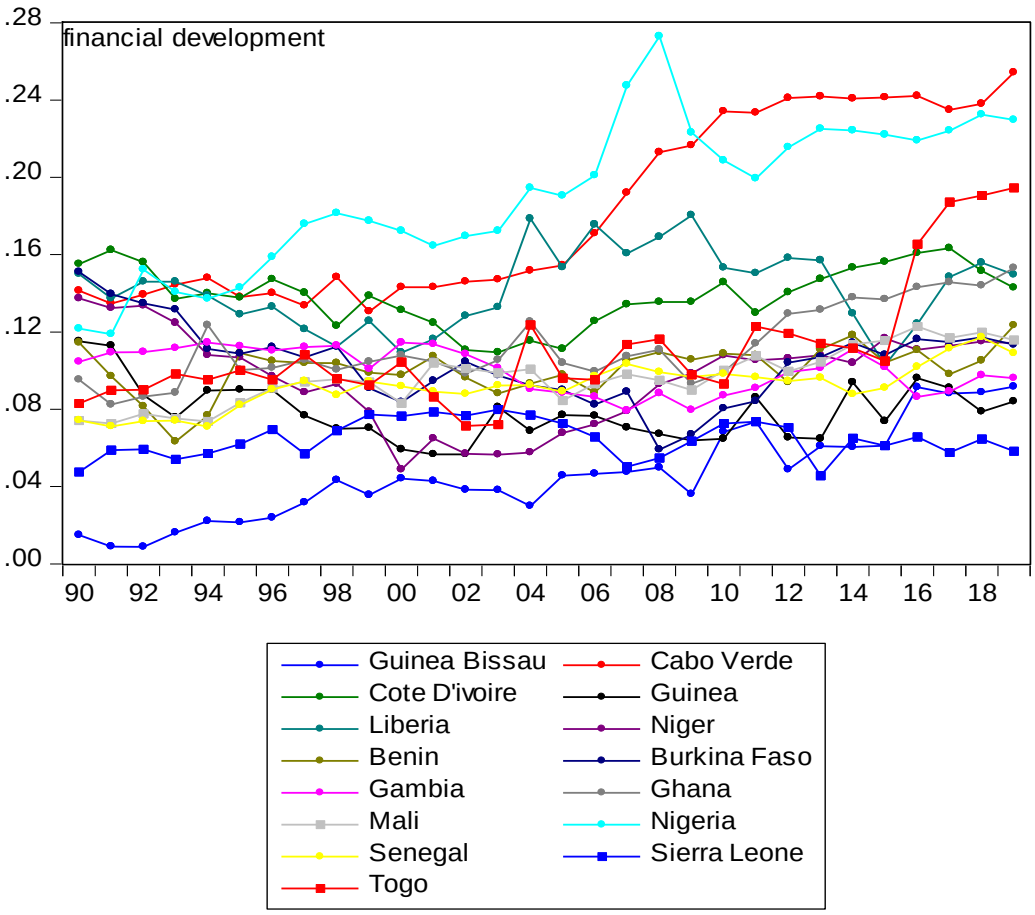
Carbon emission per capita



This graph is showing the pattern of carbon emission. We can see from the graph that 13 of the countries have a carbon emission per capita under 0.6 metric tons. Mali has the lowest carbon emission per capita which is approximately inexistent between 1990 to 1993after the second lowest carbon emitter country is Niger with a rate of emission a little bit constant kept under 0.1 metric tons with a little peak between the year 2010 and 2017. Sierra Leone emission rate is very close to that of Niger. The other countries are in between of 0.1 and 0.8 metric tons but the Nigeria emission rate starts very high in 1990 (0.8 metric tons) then continuously decreased to join the others countries rate range between 0.1 – 0.8 metric tons. Oppositely to Nigeria Cabo Verde emission rate started very low in 1990 (0.8 metric tons) and continuously grown to reach the highest rate in 2019 (1.2 metric tons) and is still in a rise.

Figure 2

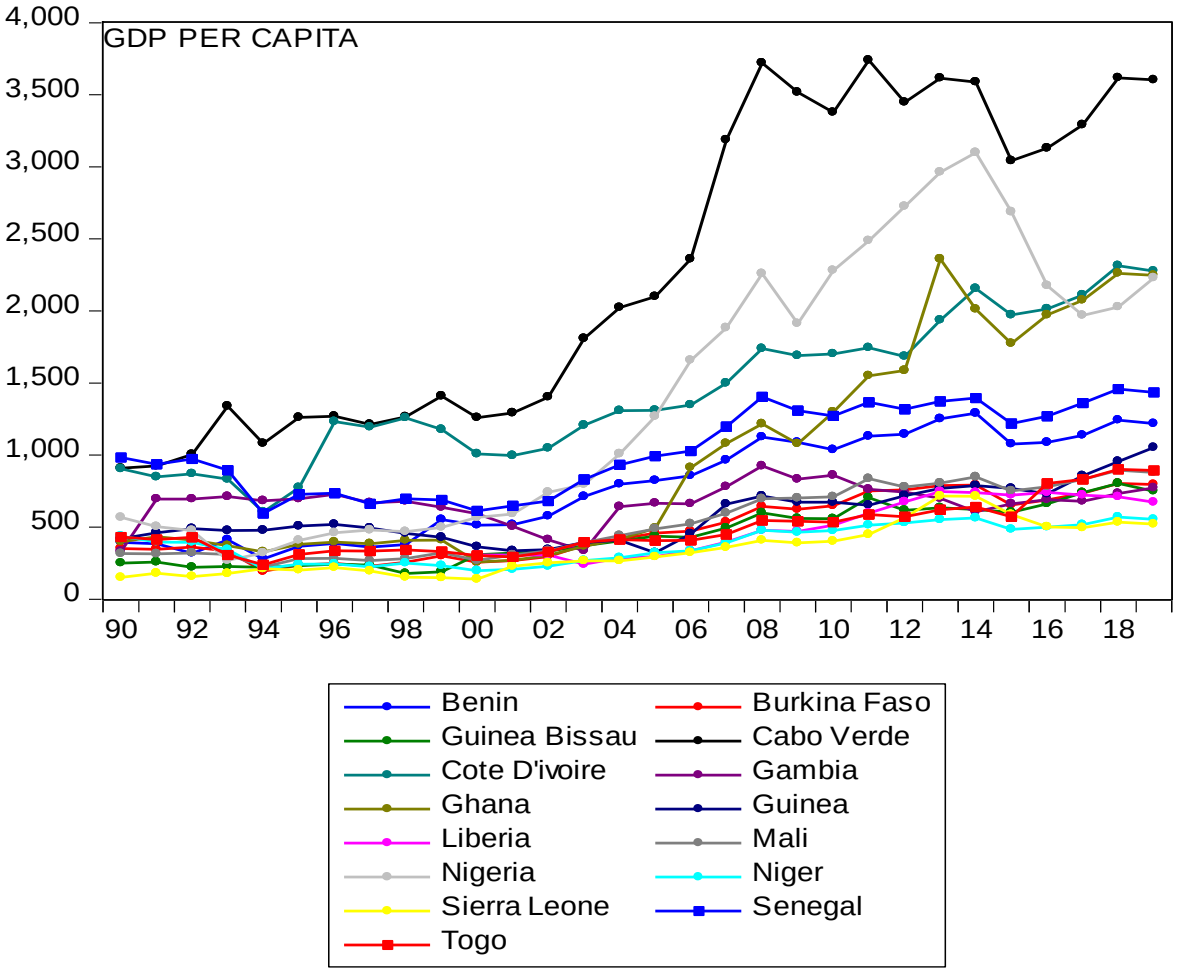
Financial development



The graph is showing the financial development level through time. The two country with the lowest financial development level are Sierra Leone and Guinea Bissau with an index each under 0.8, a rise is also noticed for guinea Bissau after 2015. The others countries have their indexes in between of 0.7 and 1.7 but the Togo and Nigeria which are the highest one are up to 2.3, we can notice a continuous grow to the side of Togo but a grow and after a peak between the year 2011 after a decrease and a grow back to the side of Nigeria.

Figure 3

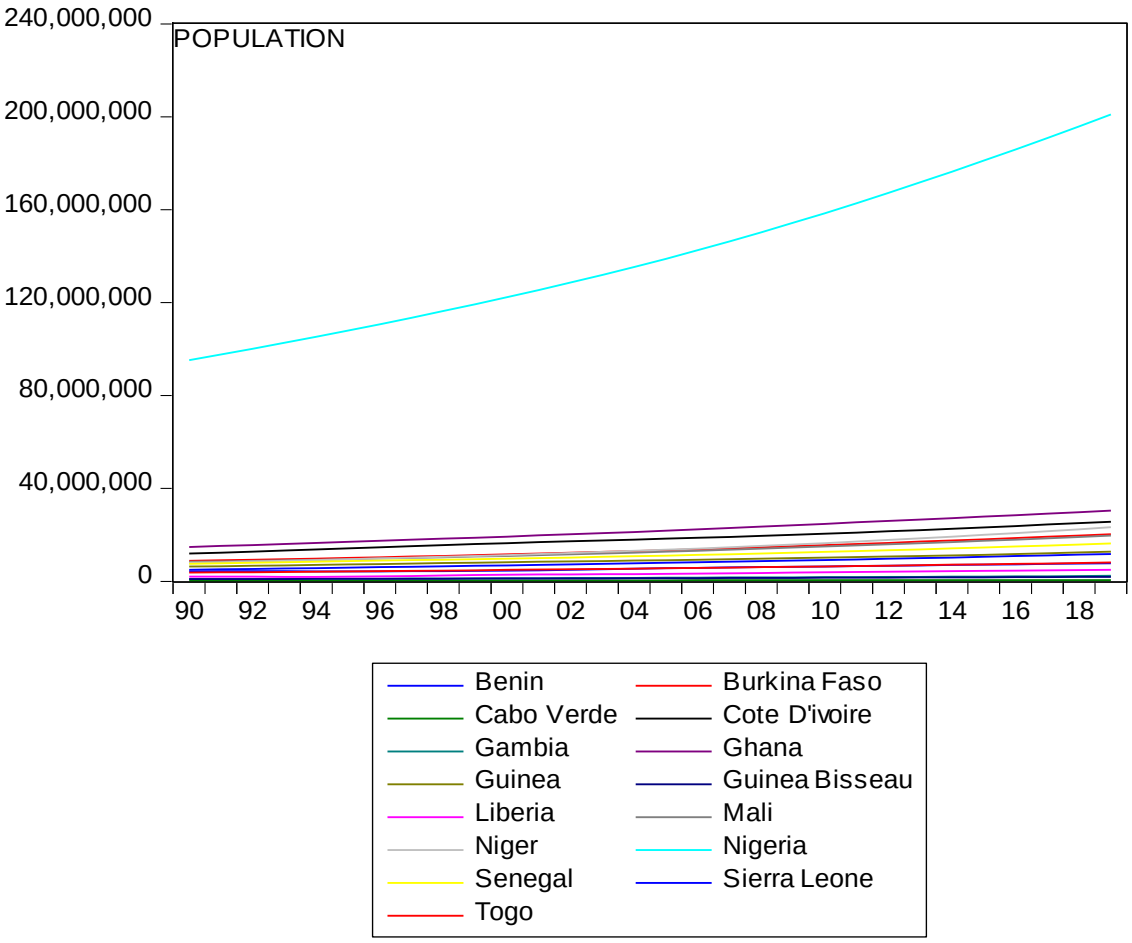
GDP per capita



From the graph we can see that the most of the countries have their GDP per capita with the increasing trend over time from 1990 to 2019. A second category of countries having their GDP per capita between 1000 and 2000, then a third category of countries with the highest GDP per capita between 2000 and 4000 which are Cabo Verde and Mali.

Figure 4

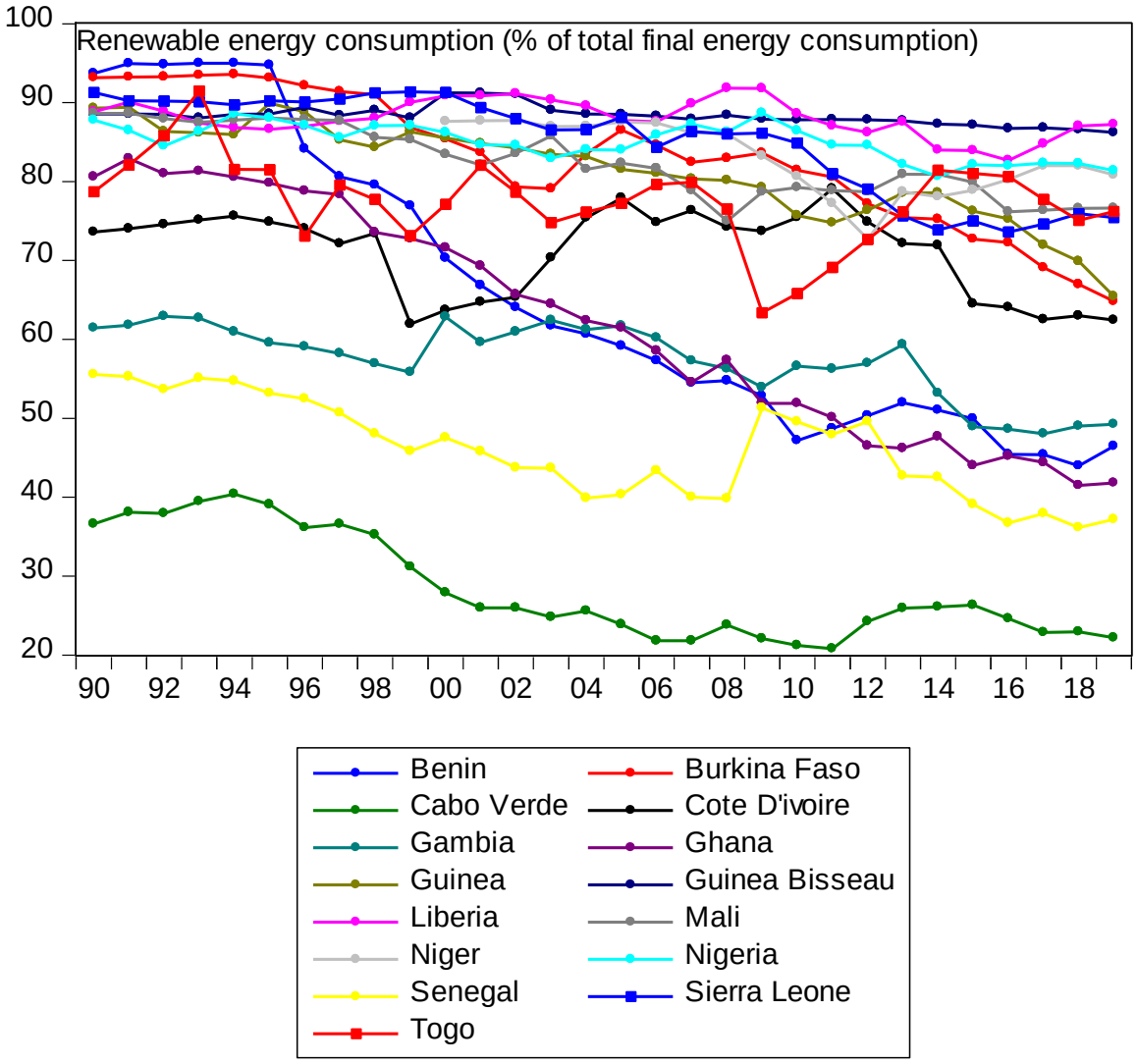
Population



The graph is showing the population rate growth, what we can witness from all of the graphs is that there is no break in the growing structure, any of the countries from 199 to 2019 and the graphs present a population still in the rise with the lowest population of all noticed in Cabo Verde. The highest of all of them in Cote D'Ivoire, Ghana, Liberia and Nigeria. A big gap of population between Nigeria and the others countries have to be notice.

Figure 5

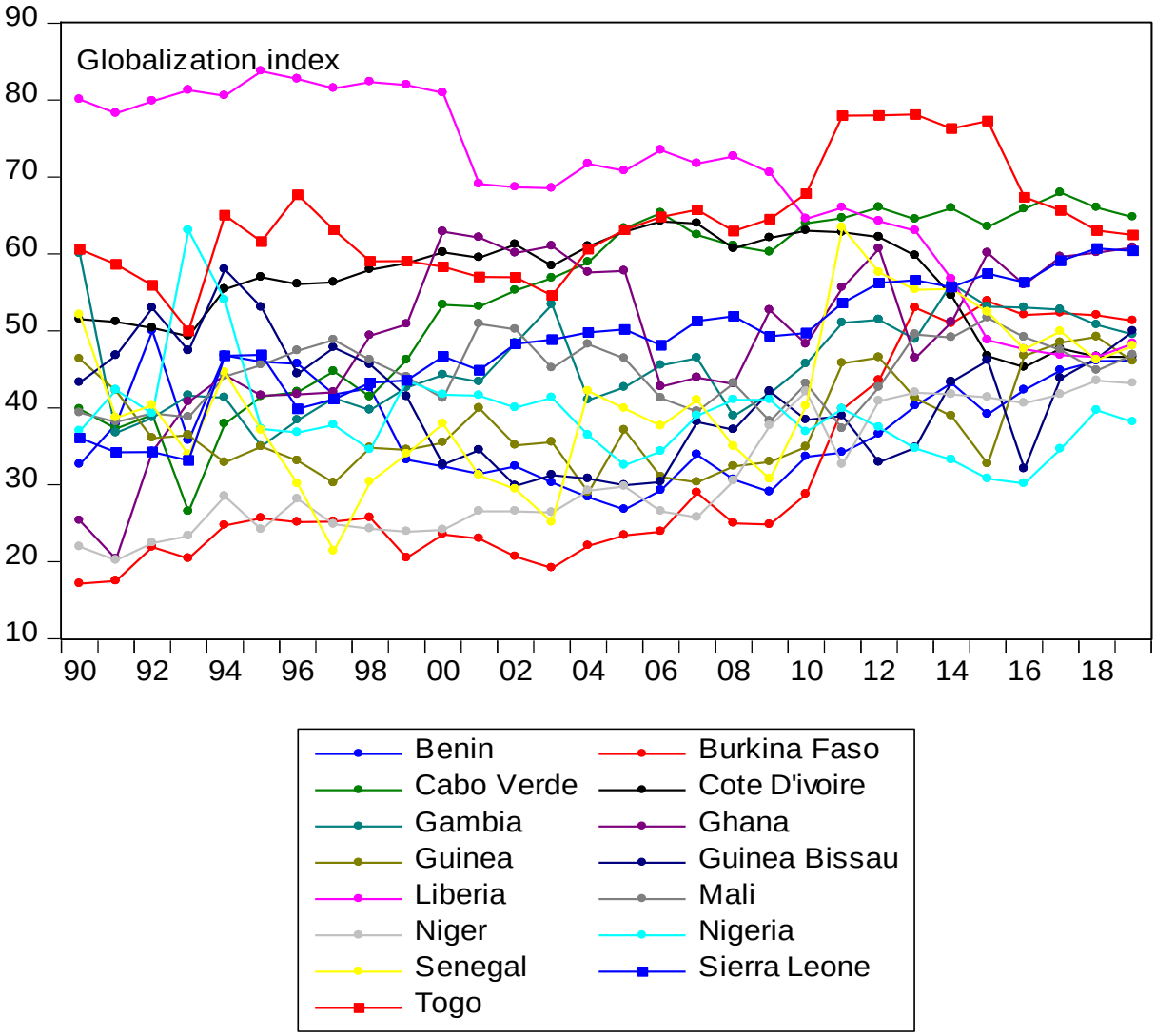
Renewable energy



The graph is showing the renewable energy consumption from 1990 to 2019. Most of the graphs are shaped which notice that Sierra Leone, Burkina Faso, Liberia, Mali, Niger and Nigeria have the very high energy consumption and just a little bit decrease over the time.

Figure 6

Globalization



The graph is showing the globalization trend from 1990 to 2019. At a first glance the graphs look starting from different origins but as the years go on they are going the all same way (in between of 30 and 70). Before the year 2011 the highest globalization was the Liberia and the lowest Togo, but, after the year 2011 until 2019 the highest was the Cabo Verde one and the lowest one for Nigeria. The others indexes stayed in between 30 and 70 through the years long.

3.2. Methodology

3.2.1. Theoretical Framework

Antweiler et al (2001) said that globalization is at the root of technological betterment through trade which permits to whittle down carbon dioxide CO2 emission and at the same time lets enhance the economic development of countries. As authors agree that globalization permits to promote trade and trade in its turns can enhance environmental quality or environmental degradation. In the purpose to support the growth, production have to be increased to maintain the trade performance, but production increase also means huge energy consumption therefore carbon dioxide increase through production. The name given to this process is called the scale effect (Grossman & Krueger, 1995); Zafar, Saud and Hou (2019); Antweiler et al. (2001). The condition at which trade is beneficial to environment is when the scale effect and composite effect are higher than technological betterment (Zafar et al. 2019). The composite effect is when the production of energy-intensive's goods generates emission. Another crucial factor that influences carbon emission is financial development. (Sadorsky, 2011) economic development is attain through financial development because is permits to promote financial efficiency and financial sector (banking sectors and stock efficiency). (Chtioui 2012; Pata 2018; Salahuddin et al. 2019) have found that population both increase and reduce environmental degradation.

Therefore, considering all of this background, the model has been thus formulated:

$$CO_2 = F\ (GDP_{PER\ CAPITA};\ FD;\ GLO;\ RE;\ POP)$$

3.2.2. Empirical Model

The variables of the model have been log-transformed because the logarithmic value will let have results with efficiency and consistency it also allows to control issues related to multicollinearity and heteroscedasticity (Zafar et al. 2019; Solarin et al. 2017). The log model of the study is as follow:

$$LCO_{2it} = \beta_0 + \beta_1\ LFD_{it} + \beta_2\ LGLO_{it} + \beta_3\ LGDP_{it} + \beta_4\ LPOP_{it} + \beta_5\ LRE_{it} + \epsilon_{it}$$

Where t is representing the time period considered for the study (1990 – 2019); i is representing the countries (1, 2, 3… 15). β_0 is the intercept of the model and ϵ_{it} is the term of error. $\beta_{1;}$ $\beta_{2;}$ β_3; β_4 and β_5 are the coefficients of the different variables.

3.2.2.1. The Cross-Sectional Dependence. This test must be conducted because of the rapid globalization that the world is facing and the expanding of the market growth liberalization, what sometime lead to interdependence of countries. Thereby it is prior to conduct a CDS test for panel studies. O'Connell (1998) and Pesaran (2006) mentioned that not testing for CDS while conducting a panel study lead to a rejection of hypothesis while testing for unit root test between the variables, which will lead to a bias or size distortion and to inconsistent findings. In order to avoid all of this, the Breusch – Pegan LM; Pesaran – scaled LM; Bias – corrected – scaled LM and Pesaran CD test are conducting. The null hypothesis of the cross-sectional dependence test is stated as follow:

H_0: there is no cross-sectional dependence

H_1: there is a cross-sectional dependence

If the values are significant, the null hypothesis will be rejected.

3.2.2.2. Panel Unit Root Test. In order to have a reliable ordinary least square results a stationary test must be conducted. Otherwise not checking for this test will provides some spurious results of R-square even for T-statistics. The null hypothesis of the panel unit root test is stated as follow:

$H_{0:}$ there is a unit root (series are none stationary)

$H_{1:}$ there is no unit root (series are stationary)

If the probability value is inferior or equal to 5% level of significance ($p \leq 0.05$), the null hypothesis will be rejected. In case the null hypothesis is rejected the series will be stabilized by applying a differencing (1^{st} differencing of 2^{nd} differencing) in order to eliminate the trend in the series.

3.2.2.3. Panel Cointegration Test. In order to test for the long run equilibrium linkage among the variables (FD; GLO; GDP; POP; RE) a Westerlund (2007) panel cointegration test will be conduct. This test has been chosen for it accurateness. The panel cointegartion null hypothesis is stated as follow:

$H_{0:}$ there is no cointegration between the variables

$H_{1:}$ there is cointegration between the variables

The null hypothesis should be rejected if the p value is inferior or equal to 0.05 ($p \leq 0.05$).

3.2.2.4. Dumitrescu-Hurlin Causality (DHS). The (DHS) panel test is conducted for the study. The test has been proposed by (Dumitrescu & Hurlin, 2012). The choice has been made on (DHS) because compare to other causality test, the DHS is superior to the other panel causality test. The DHS panel causality test is advantageous first because there is a possibility of applying this in presence or absence of cointegration in the panel studied model. Secondly it provides a reliable result for small samples size of panel data sets. Thirdly it considers the cross sectional dependence (CSD) in the series. The null hypothesis should be reject or admit on the base of the coefficient and the wald statistic.

Table 2

Descriptive statistics

	CO_2	FD	GDP	GLO	POP	RE
Mean	0.304593	0.110025	843.7979	44.17924	18550446	71.61135
Median	0.230796	0.103642	641.8452	44.55256	8919301.	78.69000
Maximum	1.181956	0.273041	3740.374	61.63387	2.01E+08	94.98880
Minimum	0.000000	0.008819	138.6987	25.62247	337953.0	20.78000
Std. Dev	0.235270	0.045340	705.5647	7.765665	35387544	18.71023
Skewness	1.460707	0.984531	2.084942	-0.02633	3.483121	-1.02554
Kurtosis	4.950280	4.340989	7.521378	2.481604	14.49677	3.066559
J – B stat	0.304593	0.110025	843.7979	44.17924	18550446	71.61135
observation	428	428	428	428	428	428

CHAPTER 4

DATA ANALYSIS RESULTS

4.1. Cross-Sectional Dependence Test

Within this globalization area of the world the interconnectedness of the countries should not be taken with a grain of salt as the study is running a panel data of cross-countries study, the cross-sectional dependence has to be a priority in order not to obtain spurious outcomes. Thereby Breusch – pegan LM; Pesaran – scaled LM; Bias – corrected – scaled LM and Pesaran CD test have been conducted.

The cross sectional dependence table has shown that there is a cross dependence at 1% level of significance in the variables.

Table 3

Cross-sectional dependence test

Variable	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
LCO_2	1322.321***	84.00314***	83.74452***	21.53709***
LFD	634.7291***	36.55478***	36.29616***	8.382992***
LGDP	2088.415***	136.8686***	136.6100***	44.54982***
LGLO	2297.699***	151.3106***	151.0520***	47.12065***
LPOP	3104.066***	206.9552***	206.6966***	55.71148***
LRE	1135.741***	71.12791***	70.86929***	29.85920***

Probalilities *p<0.1; **p<0.05; ***p<0.01

4.2. Unit Root Test

After conducting a cross-sectional dependence test, a panel unit root test has to be conduct in order to identify the stationarity of the variables for this study, two kind panel unit root test have been chosen. The first is proposed by Levin et al (2002) (LLC) and the second one by Im and Pesaran (2003) (IPS). The table 4 shows the result of the LLC and IPS unit root test for all the variables and it also presents for the same test the second difference panel unit root test results. The results have shown that all the variables are

showing the presence of unit root test at 1% level. In this order the variable have to be stabilize. A second difference transformation will be done for all the variables because the cross-sectional dependence test has already reveal that there is a cross-sectional dependence in between the variables. Therefore, only a second generation unit root test is reliable enough to give a result of quality.

Table 4

Unit root test

Variables	CIPS		LLC	
	Level	1st difference	Level	1st difference
LCO_2	0.9721	0.0000***	0.8406	0.0000***
LFD	0.0610	0.0000***	0.0174**	
LGDP	0.9996	0.0000***	0.7383	0.0000***
LGLO	0.4724	0.0000***	0.0000***	
LPOP	0.9933	0.0000***	0.0000***	
LRE	0.9928	0.0000***	0.7959	0.0000***

Significance level *p<0.1; **p<0.05; ***p<0.01

4.3. Correlation

The table 5 presents the correlation table of the variables. The variables have a positive correlation with the dependent variable CO2 except RE (renewable energy) which come to confirm the thoughts and findings in the literature. CO_2 and renewable energy are negatively correlated at (-0.5380) which means that renewable energy has a negative relationship with carbon emission meanwhile the others variables (financial development index, GDP, globalization and population) have positive relationship with carbon dioxide. The highest correlated variable to CO_2 is GDP (0.6441) what is significantly above the mean after that come globalization which very close to GDP too, with (0.5960) correlation value with co_2 emission. Then comes financial development with (0.3521). The lowest correlated variable is population with (0.0824).

Table 5

Correlation

	LCO_2	LFD	LGDP	LGLO	LPOP	LRE
LCO_2	1					
LFD	0.4305	1				
LGDP	0.6441	0.6098	1			
LGLO	0.5960	0.4966	0.6953	1		
LPOP	0.0824	0.2645	0.0803	0.3520	1	
LRE	-0.5380	-0.3625	-0.6748	-0.4524	0.4013	1

Significance level *p<0.1; **p<0.05; ***p<0.01

4.4. Panel Cointegration Test

From the table 6 we can see that the test is significant at 1% level which means that the null hypothesis is rejected, therefore there is a cointegration between the variables in others terms there is a presence of long-run cointegration in this panel study.

Table 6

Westerlund test for cointegration

Model: F (LCO2, LFD, LGDP, LGLO, LPOP, LRE)		
	Value	p-value
Variance ratio	-2.0239***	0.015

4.5. Long-Run Regression Estimation

In order to explore the long run elasticities of the variables of the study, a fully modified ordinary least square (FMOLS), a dynamic ordinary least square (DOLS) and canonical cointegrating regressions (CRR) test have been applied. A FMOLS is good to be apply because this test takes care of small samples and in plus it also takes care of the endogeneity and biasness. The tables (7; 8 and 9) are reporting the results of DOLS, FMOLS and CRR tests conducted. The tables start presenting different models with a one

to one model (between an independent and a dependent variable) and next so on increasingly until a one to five model regression which means, at this stage, that all the variables are interacting together with the depend variable. The three tables are really close in terms of variables' coefficients values even if they have some quite differences at their variables significances level.

4.5.1. Fully Modified Ordinary Least Square (FMOLS)

The first one to one model (between financial development and CO2) has proven that taken individually with carbon emission variable, a percentage increase in financial development will make increase carbon emission by (2.749) which means in a one to one regression model financial development has a negative impact on carbon emission. (2.749) is significant at 1% level while taken with the others variables of the model financial development is still significant at 1% level but this time a percentage increase in financial development will increase carbon emission by (1.479) metric ton per capita. These findings is aligned with Sehrawat, Giri and Mohapatra (2015); Zhang (2011); Gökmenoğlu and Taspinar (2015). The globalization in the two to one regression model (FD, GLO to CO2) is positively contributing to environment because of the negative sign of its coefficient (-0.0240) but taken in interaction with the others variables the globalization finally has a positive impact on carbon emission which means a percentage increase in globalization will make carbon emission increase by (0.186) at 5% percent level of significance. This finding is also aligned with the findings of Shahbaz, Mallick, Mahalik and Loganathan (2015); Senay, Res and Aykut (2018); Zahar et al. (2019). Haseeb et al. (2018) ended up with not significant GLO variable as the result of the study revealed. The third model which including GDP variables in a three to one regression model (FD, GLO, GDP to CO2) has revealed a positive impact on carbon emission at 5% level of significance but taken with all the variable, GDP keeps positively impacting the carbon emission but this time with no significance and percentage increase in GDP will cause CO2 increase by (0.0291). This finding is consistent with the findings of Ozturk and Acarawi (2013); Gökmenoğlu and Taspinar (2015); Shahbaz et al. (2015). The population variable (POP) taken into account in a fourth to one regression model (between FD, GLO, GDP, POP to CO2) has a negative impact on CO2 at first as the coefficient is negative (-0.0191) with no significance meanwhile being in interaction with all the

variable its coefficient becomes positive (0.0139) and significant at 1% percent level which means a percentage increase in POP will make CO2 increase by (0.0139) metric ton per capita. The finding is consistent with the findings of Say and Yücel (2006). Significant at 1% percent level, with a negative impact on carbon emission, a percentage increase in renewable energy (RE) will make CO2 reduce by (-0.337). This result is also confirming the findings of Majeed and Luni (2019); Farhani and Shahbaz (2014); Bölük and Mert (2016).

Table 7

Result from the fully modified ordinary least square (FMOLS)

Dependent variable: CO2

Regressors	(1)	(2)	(3)	(4)	(5)
LFD	2.749***	3.510***	2.002***	2.308***	1.479***
	(0.229)	(0.614)	(0.636)	(0.667)	(0.415)
LGLO		-0.0240	-0.269***	-0.129	0.186**
		(0.0194)	(0.0778)	(0.131)	(0.0925)
LGDP			0.169***	0.129**	0.0291
			(0.0504)	(0.0549)	(0.0367)
LPOP				-0.0191	0.0422***
				(0.0186)	(0.0139)
LRE					-0.337***
					(0.0459)
Observersations	449	449	449	449	449
R-sqaured	0.348	0.215	0.298	0.152	0.247

Standard errors parentheses *p<0.1; **p<0.05; ***p<0.01

4.5.2. Dynamic Ordinary Least Square (DOLS)

The one to one regression model (between FD and CO2) of the table is very close to the result of FMOLS. As previously, financial development has a positive impact on carbon emission and significant at 1% percent level while interacting with all the others variables (GLO, GDP, POP and RE) it still having positive effect therefore a percentage increase in FD will make CO2 emission go up by (1.778). The variables are still significant

at 1% level. This finding is in line with Farhani and Ozturk (2015); Seker, Ertugul and Cetin (2015) findings. The two to one regression model (between FD, GLO and CO2) also close to the previous result is showing a none significant GLO index with a negative impact on carbon emission with (-0.0207) as coefficient which means it reduces carbon emission at first but interacting with all the study variables the GLO remains not significant but this time with a positive impact on carbon emission, in this case 1% increase in GLO index will cause (0.209) metric per capita increase in CO2. The finding is aligned with Phong (2019); Sharif, Afshan and Qureshi (2019) findings. The three to one regression model (between FD, GLO, GDP and CO2) almost identic to the previous result is showing a GDP significant at 1% level and with a positive impact on CO2 so increase the metric ton per capita of CO2 at first and as well even while interacting with all the variables it keeps having a positive impact on CO2 with 1% increase in GDP driving to (0.0276) increase in GDP but this time GDP is not significant anymore as before. The result is the same as Siddique, Majeed and Ahmad (2016); Dinda (2004); Zafar et al. (2019) results while conducting their studies. The four to one model of regression (between FD, GLO, GDP, POP and CO2) taking population now into account shew that POP negatively impacts CO2 (-0.0183) with none significance at first turned significant at 10% level and also turned positive impacted carbon emission while interacting with the others variables and a percentage increase in POP will make carbon emission rise by (0.0343) metric ton per capita. This finding is also confirm by Fan et al. (2006); York et al. (2002) findings. The five to one regression with all the variables of the model has shown that renewable energy is significant at 1% level of significance and has a negative impact on carbon emission which means that it whittles down carbon emission as 1% increase in RE consumption will cause the mitigate of carbon emission by (-0.333) metric ton per capita. These findings is supported by Tit et al. (2019).

Table 8

Result from the Dynamic ordinary least square (DOLS)

Dependent variable: CO2

Regresors	(1)	(2)	(3)	(4)	(5)
LFD	2.800***	3.420***	2.185***	2.311***	1.778***
	(0.237)	(0.676)	(0.532)	(0.740)	(0.576)

Table 8 (*continued*)

LGLO		-0.0207	-0.270***	-0.163	0.209
		(0.0212)	(0.0648)	(0.146)	(0.133)
LGDP			0.167***	0.147***	0.0276
			(0.0423)	(0.0616)	(0.0525)
LPOP				-0.0183	0.0343*
				(0.0199)	(0.0182)
LRE					-0.333***
					(0.0629)
Observersations	447	447	447	447	447
R-sqaured	0.420	0.447	0.543	0.552	0.734

*p<0.1; **p<0.05; ***p<0.01

4.5.3. Canonical Cointegrating Regressions (CCR)

This table likewise the two others tables shows slightly different implications of the variables. The first variables in interaction with the dependent variable is financial development (FD), this variable in the one to one regression model highly meaningful at 1% and also positively impact carbon emission. Taken into group in a regression taking into account all the others variables (FD, GLO, GDP, POP and RE) it keeps its significance at 1% and still impact CO2 positively, thus a percentage increase in financial development will make CO2 rise by (1.476) metric ton per capita, the finding is supported by Shahbaz, Mutascu and Azim (2013); Ito (2017), Giannetti et al. (2010) findings. The entrance of globalization makes the regression comes to a two to one regression model. At first globalization is not significant at all and negatively impacts CO2 by lessen emission but taken with all the others variables the coefficient of globalization turned positive therefore a percentage increase in globalization index will make go up carbon emission by (0.184) metric ton per capita and this time the variable is significant at 10% level. The findings is consistent with Majeed and Mazhar (2019); Shahbaz et al. (2015). GDP first comprise in a three to one regression (between FD, GLO, GDP and CO2) was significant at 1% level and was positively impacting carbon emission but taken in group with all the variable GDP becomes none significant but stays positively impacting carbon

emission therefore a percentage increase in CO2 emission will make carbon emission increase by (0.0298) metric ton per capita. This finding can get support with the findings of Nasreen and Answar (2015); Jamel and Derbali (2016); Javid and Sharif (2016). POP, into a four to one regression (between FD, GLO, GDP, POP and CO2) first negatively impacts carbon emission with no significance but in interaction with all the others variables, its coefficient turned positive and significant at 1% level therefore a percentage increase in POP will make CO2 increase by (0.0420) metric ton per capita, this result can be support by Pata (2018); Tobias and Heinz (2012) works. This table result show that a percentage increase in renewable energy will whittle down carbon emission by (-0.335) so renewable energy consumption has a negative impact on carbon emission. This result is significant at 1% level of significance. The support from the literature are Alam, Begum, Buysse and Van Huylenbroeck (2012); Omri (2013); Hossain (2011) findings.

Table 9

Result from the canonical cointegrating regressions (CCR)

Dependent variable: CO2

Regresors	(1)	(2)	(3)	(4)	(5)
LFD	2.749***	3.519***	1.995***	2.314***	1.476***
	(0.229)	(0.624)	(0.656)	(0.691)	(0.426)
LGLO		-0.0242	-0.269***	-0.127	0.184*
		(0.0196)	(0.0801)	(0.136)	(0.0298)
LGDP			0.169***	0.128**	0.0298
			(0.0521)	(0.0573)	(0.0385)
LPOP				-0.0193	0.0420***
				(0.0188)	(0.0138)
LRE					-0.335***
					(0.0464)
Observersations	449	449	449	449	449
R-sqaured	0.347	0.291	0.299	0.192	0.217

*p<0.1; **p<0.05; ***p<0.01

4.6. Findings and discussion (overall tables result summary)

The tables (7, 8, and 9) are the FMOLS; DOLS and CRR tables giving the result of the model equation. Each table result has been detailed above but now a condensed result of the three tests have to be given. The three methods are unanimous about the impact of the variables on carbon emission with some close value of the tests conducted. The GDP is the only variable which not significant over the five variables. The methods (FMOLS; DOLS; CRR) settle on the fact that financial development (FD) has a positive impact on carbon emission, so an increase of FD index will heighten CO2 by a value comprise in the interval of (1.476 – 1.4779) because with the presence of many international banks like (African Development Bank); Caribbean Development Bank; the World Bank Group and Islamic Development Bank); some regional bank like BCEAO (central bank of west African states) and some national banks like (Coris bank; NSIA bank) even the presence of some micro finance institutions render the loans very accessible to people and people by borrowing money will stimulate the economic growth and increase demand (Gunasekaran et al. 2014) which will increase production and release CO2 in the air. This stimulated economic growth will of sure attract some international investors (firms) to take place in the region Farhani et al. (2014) as the CFAO group and Heineken wanted to build in Abidjan (Cote D'Ivoire) in 2017 the biggest alcohol beverage industry of West Africa. The growing import of the second hand cars from the Europe to ECOWAS region is also the cause of this CO2 increase through FD as Wang et al. (2019) defended the opinion that even consumers produce CO2. Indeed, those cars, sometimes are in a very bad condition when they are imported in Africa, qualified as lemon car by Akerlof (1970) those cars used in the region release some dark smoke into the air which is a CO2. For instance, Cote D'Ivoire government banned the import of second hand car up to five years in 2017. FD is significant at 1% level for all the tests. Globalization (GLO) like financial development is unanimously contributing positively to carbon emission even if the significance value is not similar for all the tests. GLO augment CO2 emission in the region because the ECOWAS countries are deeply involving in trade. The signature of an agreement of an economic partnership (APE), this agreement was supposed to progressively remove the barriers to import of European products over 10 or 12 years (Solman, Nuñez & Menéndez, 2001). As the countries of the region are massively

agricultural countries (either representing 35% of the ECOWAS GDP), we all know practicing trade involve transportation; as the distribution channel is very important in business, therefore those transportations means use throughout the region in a purpose of out-boundaries and in-boundaries trade generate CO2, thereby an increase in the trade activity will make increase the transportation means which in its turns will increase CO2, idea supported by Haseeb et al. (2018). As previously mentioned, the second hand car sold in the region are most at the root of pollutant transportation mean. Agriculture as the huge part of the trade benefit of some countries (agriculture is 41% of the benefit of Burkina Faso export for only cotton sales; 48% for Ghana for only cocoa sales and 35% for Cote D'Ivoire) the trade of those agriculture items will make rise the financial flows and labor flows, therefore the economy will get expand and more CO2 will be produce as financial development has a negative impact on environment degradation, this is supported by (Fischer, 2003 ; Krueger; 1991) works. GDP, with a proof of no significance throughout all the three tests; also impacts positively the carbon emission. This positive impact is due to an economic good performance of the region. As the GDP per capita index was constantly in the rise during 16 years over 19 years (from 2000 to 2019); (table of ECOWAS GDP per capita increase index in %); (the table is in the appendix part), therefore the demand in the region was in the rise. Indeed during this period of time many industries have been created in region namely: a new Dangoté ciment subsidiary of the Dangoté group (in Nigeria); opening of the prestige cement Cote D'Ivoire (PCCI) in 2017; opening of the Cote D'Ivoire cement firm (SCCI); opening of a second subsidiary of CIMAF in San Pedro (Cote D'Ivoire); opening of a vehicle assembly company in 2018 in Cote D'Ivoire, this trend opening of capital intensive industries will have effect because the industries by producing more will not only have more outputs but they will also generate more CO2 in the air (Solarin et al. 2017); also the increase in production will require more energy consumption like fossil sources which will consequently increase environmental degradation due to the scale effect (Prieur, 2008 ; Torras & Boyce, 1998). The insignificance of the GDP on carbon emission is due to the fact that the ECOWAS countries might not have a large manufacturing sector and because of that the energy consumption will not increase as well. This findings is supported by Naceur and Omran (2008). In addition the GDP is not significant in the analyses because the ECOWAS

countries are more labor abundant than capital abundant despite the fact that the region GDP's is constantly in the rise, therefore the labor factor (L) overtakes the capital factor (k). As the population of the ECOWAS is in majority young, it makes it an abundant and cheap labor available all over the ECOWAS countries. Thus the items produce in the region are more labor intensive than capital intensive. The fact that agriculture counts for 35% of ECOWAS GDP is a proof of the evidence advanced. Another things to take into consideration in the high level of traditional manufacturing of those labor intensive items which are less pollutant than the modern manufacturing methods. POP also rises the carbon emission as the tests proved that it has a positive impact on CO2. This rise of CO2 in ECOWAS is first due to the population age range. As the median age in the ECOWAS region was 18 in 2019, this population with almost 50% of adult are aged eligible for loans which increase their purchasing power and allow them to purchase CO2 emitter good like (car, fridge, heater) as Cole and Neumayer (2004); Shi (2006); Fan et al. (2006) by discriminating on age have shown that the population in between (15 – 64) are most carbon emitter due to their purchasing power as same as ECOWAS population. Going in the same path with Dalton et al. (2008) it could be said that the 345 million of ECOWAS population are all CO2 emitter as Dalton et al. (2008) found that human no matter the age, POP makes CO2 emission go up, even if O'neil and Chen (2002) think that adult do more because they are financial independent so they have more purchasing power than teenagers. Going to the consumption side it also obvious that as the ECOWAS' population is still being growing (as the population graph has shown) the more this population will be the more the enterprises will produce to satisfy this population needs, the more the cities will get expand to let this population get accommodation, the more urbanize the countries will be; opinion supported by Chitoui (2012); Pata (2018) studies. RE is the only variable of the model which lessen CO2 as the coefficients throughout all the test are negative and the values are really close. The unanimous significance of the variable too at 1% level have to be notice. The reducing of carbon emission by RE is due to the presence of many dams in the region (in all of the fifteen countries), these dams are one of the most ecological way of producing electricity therefore it contributes to environmental quality as it is an ecological mean of providing electricity.

Table 10

Summary table of three regression methods (FMOLS, DOLS, CCR)

Variables	FMOLS	DOLS	CRR
LFD	1.479***	1.778***	1.476***
	(0.415)	(0.576)	(0.426)
LGLO	0.186**	0.209	0.184*
	(0.0925)	(0.133)	(0.0298)
LGDP	0.0291	0.0276	0.0298
	(0.0367)	(0.0525)	(0.0385)
LPOP	0.0422***	0.0343*	0.0420***
	(0.0139)	(0.0182)	(0.0138)
LRE	-0.337***	-0.333***	-0.335***
	(0.0459)	(0.0629)	(0.0464)
Observersations	449	447	449
R-sqaured	0.247	0.734	0.217

*p<0.1; **p<0.05; ***p<0.01

4.7 Result of Dumitrescu-Hurlin Causality (DHS)

The table shows the result of the Dumitrescu-Hurlin Causality test. A unidirectional causality direction is only seen from FD to CO2 (FD → CO2) which indicates that financial development cause CO2 augmentation. This outcome is consistent with Lee (2013); outcome for G20 countries. Bidirectional causality direct is observed between CO2 and GLO; GDP; POP and RE. The finding is in line with Shahbaz et al. (2013) outcome for GDP in Malaysia; with Tang and Tan (2015) for RE in Vietnam and with Shujah-ur-Rahman, Chen, Saud, Bano and Haseeb (2019) for GLO IN 16 CEE countries.

Table 11

Dumitrescu-hurlin panel causality tests

Hypothesis	w-statistic	p-value	Result	Conclusion
Co_2→LFD	1.5194	0.1549	No	Unidirectional causality between co2 and FD
LFD→Co_2	4.2113	0.0000	Yes	
Co_2→LGDP	1.9443	0.0097	Yes	Bidirectional causality between co2 and GDP
LGDP→Co_2	4.1165	0.0000	Yes	
Co_2→LGLO	5.1918	0.0000	Yes	Bidirectional causality between co2 and GLO
LGLO→Co_2	9.2023	0.0000	Yes	
Co_2→LPOP	3.3279	0.0000	Yes	Bidirectional causality between co2 and POP
LPOP→Co_2	1.7541	0.0389	Yes	
Co_2→LRE	4.0798	0.0000	Yes	Bidirectional causality between co2 and RE
LRE→Co_2	2.0636	0.0036	Yes	

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

5.1Conclusions and Discussions

This study was investigating the effect of financial development and globalization in the ECOWAS countries between 1990 and 2019. A panel model study has been used in order to provide a comprehensive understanding of the effect of those factors in the ECOWAS. In order to archive this purpose, the study used to apply the Breusch – pegan LM; Pesaran – scaled LM; Bias – corrected – scaled LM and Pesaran CD test to assess the cross-sectional dependence which reveal a presence of cross-sectional dependence between the variables of the model. The long-run relationship finding between the variables in the ECOWAS countries has been carried out through the Johansen Fisher panel cointegration test. After the long-run relationship investigation a FMOLD, DOLS, CRR approaches have been apply to the log-transformed regression model. The findings imply that an increase in globalization, financial development, GDP and population will reduce environmental quality meanwhile renewable energy enhance environmental quality by reducing CO2 emission. Indeed, as the presence of many types of banks have been remarked in ECOWAS there is facile accessibility to loans which increase the purchasing power for CO2 emitter goods. Thus, financial development has a negative effect on environmental quality. The ECOWAS' population being the consumer of those CO2 emitter goods like the second hand car, it is clear that the more this population will grow the more CO2 will be release in the air therefore this population has a positive impact on environmental degradation as the findings suggested. Globalization impacting CO2 emission positively, this factor by facilitating trade between countries requires transportation mean for the distribution channel, therefore as cars have already pointed out as CO2 emitter, the more the trade increase the more transportation is used, the more the environment quality is lessening. The GDP as the measurement of economic growth this factor by increasing, also increase the purchasing power, therefore lead to the demand rise which leads industries to produce more and therefore impact positively CO2 emission. Through the findings we have seen that renewable energy has a negative impact on CO2

because against all waiting renewable energy can contribute to environment quality as the energy technologies concept does exist like consuming electricity from solar power, wind power or hydroelectric power which are ecological way to produce electricity, what all of the ECOWAS countries do.

5.2 Implication and Recommendation

First the ECOWAS countries have to be aware about the ecological impacts of the financial development, population, GDP per capita and globalization on their environment. Then in order to reduce this environmental damage they have to implement some policies in order to: first implement some eligible criteria to the foreign industries willing to implement themselves in the ECOWAS also forbid some goods who have a bad impact on environment like the second hand cars. In plus the countries could impose a quota of 'green research' or action having a good externalities on environment to financial development to fund per year. In addition the countries should sensitize their population about being 'green friendly' and at las last renewable energy have a good effect on environment they should start consume more renewable energy. (Wang et al, 2015).

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APPENDICES

APPENDIX A

Table of ECOWAS GDP per capita increase indexes in %

Country Name	Indicator Name	2000	2001	2002	2003
Benin	GDP per capita (current US$)	512,673902	518,06747	574,9298	711,28495
Burkina Faso	GDP per capita (current US$)	255,718687	267,0976	294,66539	374,62736
Cabo Verde	GDP per capita (current US$)	1259,35307	1292,2265	1401,8911	1809,11
Cote d'Ivoire	GDP per capita (current US$)	1007,46739	997,47878	1047,7523	1207,5126
Gambia	GDP per capita (current US$)	594,149388	505,42164	411,77189	335,90622
Ghana	GDP per capita (current US$)	258,47104	269,01498	304,56464	367,82136
Guinea	GDP per capita (current US$)	363,482279	336,15402	343,60263	393,73969
Guinea-Bissau	GDP per capita (current US$)	308,910318	319,95745	333,05858	372,05619
Liberia	GDP per capita (current US$)	306,833864	306,71025	306,47394	243,08958
Mali	GDP per capita (current US$)	270,543007	307,70583	336,41717	393,40676
Niger	GDP per capita (current US$)	197,832683	208,37706	228,23591	268,34989
Nigeria	GDP per capita (current US$)	567,930722	590,38182	741,74749	795,38623
Senegal	GDP per capita (current US$)	613,732384	648,44147	681,31185	831,83104
Sierra Leone	GDP per capita (current US$)	138,698722	229,37566	252,39601	266,44691
Togo	GDP per capita (current US$)	302,958592	292,8231	328,39811	396,92058
TOTAL		6675,99469	6815,9321	7280,7118	8397,0302
indices AG EN %			2,096128	6,8190198	15,332544

(Table continued)

2004	2005	2006	2007	2008	2009	2010	2011
798,7443	822,7851	856,0549	966,2036	1125,426	1088,758	1036,535	1130,273
418,3767	457,9334	473,4499	535,0623	643,4046	624,1752	647,8361	751,1728
2024,266	2099,148	2361,38	3186,78	3721,22	3517,43	3378,323	3740,374
1308,288	1309,592	1347,989	1500,168	1738,192	1689,345	1701,476	1744,939
642,7562	665,7202	662,3629	780,3811	924,5099	833,2814	860,6364	762,7631
417,5081	492,5441	913,3938	1081,166	1217,064	1077,662	1299,345	1549,463
407,301	322,4155	453,4037	659,9929	715,0965	674,0855	672,4249	651,1361
405,0751	436,4752	430,0039	493,722	599,9952	559,4146	558,1747	703,6606
286,0647	294,8932	336,1157	396,6018	478,3995	470,9481	513,4456	596,8966
440,9584	489,0229	523,043	597,4798	697,0878	701,712	710,2743	837,6058
286,4901	321,7237	336,282	390,2845	478,5026	464,058	476,8695	512,5953
1007,874	1268,383	1656,425	1883,461	2259,114	1911,608	2280,437	2487,598
932,1681	992,6881	1027,731	1197,41	1403,949	1308,938	1271,583	1366,775
266,5694	292,3491	323,389	360,3717	408,481	391,2009	401,8349	448,3377
413,3299	406,5624	408,0571	449,7383	546,3504	540,6087	534,0448	587,0975
9669,996	10292,78	11728,23	14059,07	16446,87	15348,66	15844,8	17322,73
15,15971	6,440357	13,94618	19,87376	16,98405	-6,67732	3,232479	9,327543

(Table continued)

2012	2013	2014	2015	2016	2017	2018	2019
1145,14	1251,21	1291,41	1076,797	1087,287	1136,594	1241,825	1219,516
758,0004	787,4694	792,8462	653,3273	688,2507	734,9963	804,5005	796,1152
3447,483	3616,036	3588,626	3043,031	3131,018	3292,634	3616,461	3603,775
1684,782	1935,947	2156,646	1972,546	2013,381	2111,027	2314,051	2276,332
742,7776	700,516	607,4299	660,7236	690,7805	679,7551	732,7207	772,5056
1587,561	2361,09	2012,264	1774,075	1971,957	2074,291	2260,861	2246,626
717,0505	769,0032	787,2386	769,2555	732,2915	855,5753	955,1113	1052,588
616,3757	634,662	623,3131	603,3994	661,4578	738,5499	802,7674	749,4537
675,0102	747,8687	739,9119	721,5811	740,9149	721,085	710,266	672,3405
778,6252	805,0339	848,279	751,4729	780,7235	830,0214	894,8048	879,0432
529,7445	552,5691	564,5967	484,1531	500,2149	517,7716	570,7239	554,0994
2723,822	2961,549	3098,986	2687,48	2176,003	1968,565	2027,779	2229,859
1317,78	1372,666	1396,657	1219,249	1269,903	1361,702	1458,082	1435,83
566,3782	716,8358	714,6998	588,2289	501,4152	496,6823	533,9915	521,7548
571,8067	621,3989	640,9342	570,91	803,1519	830,7453	901,523	893,3525
17328,65	19253,88	19265,63	17043,38	16999,14	17574,63	18984,05	19069,4
0,034182	11,11011	0,06103	-11,5348	-0,25956	3,385406	8,01959	0,449587

Note: TOTAL= the total of the GDP per capita of all the countries for the same year.

Indices AG IN %: indexes of augmentation in percentage

Indices AG IN %= (Y_1 / Y_0) * 100 – 100

Year 2000 is the starting year

APPENDIX B

Globalization index consists of three indices: economic, political and social. The globalization index is a weighted average of economic globalization (36%); social globalization (38%) and political globalization (26%).

The indices of Economic globalization capture

1. Actual flows
   - Trade (percent of GDP);
   - Foreign Direct Investment (percent of GDP);
   - Portfolio Investment (percent of GDP);
   - Income Payments to Foreign Nationals (percent of GDP)

2. Restrictions
   - Hidden Import Barriers, Mean Tariff Rate, Taxes on International Trade (percent of Current Revenue)
   - Capital Account Restrictions

The Social globalization captures.

1. Data on Personal Contact
2. Data on Information Flows
3. Data on Cultural Proximity

The Political globalization captures

1. Embassies in Countries
2. Membership in International organizations
3. Participation in U.N. Security Council Missions and International Treaties

APPENDIX C

The financial development index is constructed using a standard three-step approach found in the literature on reducing multidimensional data into one summary index: (i) normalization of variables; (ii) aggregation of normalized variables into the sub-indices representing a particular functional dimension; and (iii) aggregation of the sub-indices into the final index.

Financial development is the development of financial institutions, financial markets, and financial instruments.

- A financial institution (FI) is a company engaged in the business of dealing with financial and monetary transactions such as deposits, loans, investments, and currency exchange.
- A financial market is a market in which people trade financial securities and derivatives at low transaction costs. Some of the securities includes stocks and bonds, raw materials and precious metals, which are known in the financial markets as commodities.
- Financial instruments are monetary contracts between parties. They can be created, traded, modified and settled. They can be cash (currency), evidence of an ownership interest in an entity or a contractual right to receive or deliver in the form of currency (forex); debt (bonds, loans); equity (shares); or derivatives (options, future, forwards).