IMPACT OF CARBON EMISSIONS ON ECONOMIC GROWTH IN NIGERIA

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ABSTRACT

Studyon carbon emissions and its economic impact on Nigerian economy are very important for creating awareness and providing the background information for targeting policies adequately. To address the problem of carbon emission in Nigeria, this study covers a period from 1980 -2010. Secondary data was collected from central Bank of Nigeria, carbon dioxide information analysis annual publication and international energy agency. The variables used include; gross domestic product, emissions from fossils fuel, gas fuels, liquid fuels and solid fuels. This was subjected to ordinary least squares method of analysis. The result reveals that carbon emissions have negative impact on economic growth in Nigeria. Based on the above findings it is recommended as follows, that oil – producing countries like Nigeria should be compensated through the implementation of the Kyoto protocol agreement, there should be policy measures to reduce its greenhouse gas emissions and that concerted effort by both the government and oil multinational firms and the private sector must pursue these policies vigorously to bring about carbon emission free state.

Keywords: Nigeria, Carbon emissions, gross domestic product, environment.

INTRODUCTION

In recent years, there has been increased concern in environmental degradation, both in term of quality and quantity. Deforestation, soil degradation, and loss of biological diversity have become part of everyday issues. Moreover, most causes of air and water pollution and global warming are fairly well known as the result of increased and uncontrolled human activities at different stages of economic development such as agriculture, industries, transportation, and energy generation**.** Pollution is basically as a result of carbon emission, otherwise known as $C0_2$. Carbon emissions can be defined as those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring (Sanglimsuwan, 2011).

As described by Gaber (2011), the take-off stage of development and industrialization progress can lead to increased environmental damage due to greater use of natural resources, more emission of pollutants, the operation of less efficient and relatively dirty technologies, and disregard for the environmental consequences of growth. However, as economic growth continues, the heavy industries are shifted to knowledge-based and service industries which are cleaner (Shafik, 2002). Moreover, at higher levels of development, there are increased environmental awareness and enforcement of environmental regulation that can lead to gradual decline of environmental degradation (Stern, 2009).

The effects of carbon emissions have been devastating, affecting both the environment and human beings in habiting the environment. The outbreak of various environmental hazards as a result of the changes in environmental temperature or atmospheric imbalance in recent years is alarming. Such hazards include, among others, the vulnerability of the economic sector to the recurrent droughts, flood and cyclones, decline of some plant and animal populations, spread of diseases vectors including malaria, freezing and breaking-up of ice on

rivers and lakes, reduction in food production, increase in death rate and threat to sustainable development.

Human economic activities in Nigeria have, in the last 50 years, contributed to an increase in carbon emissions and the concentration of greenhouse gases in the atmosphere leading to the enhanced greenhouse effect, which in turn is expected to result in climate change, arguably the most important and dangerous, and certainly the most complex global environmental issue today. The rest of the paper is organized thus; following this introduction is part 2, which looks at the trend of carbon emission in Nigeria since 1980 to 2010. Part 3, is the literature review which is subdivided into theoretical, empirical and methodological reviews. Part 4 covers the theoretical framework, model specification, description of variables, source and nature of data and method of analysis. Part 5, covers the analysis of result, interpretation discussion and policy implications of findings and part 6 is the conclusion and recommendations.

Trend of Carbon Emissions in Nigeria

Year	Fossil fuels	Gas fuels	Liquid Fuels	Solid fuels	Cement Products
1980	694	5753	130	11,737	272
1981	2685	6811	78	8072	340
1982	2685	7944	44	6727	490
1983	1204	8037	42	6570	49
1984	1075	10298	55	7152	407
1985	1467	9689	101	7350	454
1986	1728	10405	81	7306	525
1987	1830	7345	56	6435	517
1988	1975	9060	44	7738	476
1989	2168	8891	39	0	476
1990	2041	9823	35	0	476
1991	2489	9298	6	0	476
1992	2618	14531	68	0	476
1993	2860	13049	35	0	435
1994	2803	9466	99	0	350
1995	2747	6315	106	0	354
1996	2784	778	106	0	346
1997	2911	7694	12	0	343
1998	3123	7455	13	0	367
1999	3287	8572	15	0	340
2000	3664	8553	5	9030	340
2001	3206	9113	5	10080	326
2002	4260	10201	34	11978	286
2003	3793	9067	19	12207	313
2004	5065	8420	4	12662	313
2005	5307	10616	8	12075	367
2006	5962	7025	8	11707	449
2007	5941	5868	8	11707	639
2008	6718	8695	8	10013	680
2009	6834	7584	8	11024	655
2010	6490	8241	8	12656	672

Source: CBN Statistical Bulletin, 2011

LITERATURE REVIEW

The literature review in this paper is organized under the following sub-headings:

Theoretical Review; Empirical Review and Methodological Review.

Theoretical Review

Some theories have concentrated on the negative effects of industrialization on economic growth. Since the times of Malthus, Ricardo and Mill, economists like Galbraith, Mishan, Carson, Boulding, and Commoner, have voiced their concern about the harmful effects of economic growth on the environment. They are of the view that growth has produced pollution and wasteful consumption of trivia that contribute nothing to human happiness (Galetotti, et al, 2009).

According to Galetotti, et al (2009), the views of these economists have been termed "The Limits to Growth Model". This model states that the objectives of economic growth are to be reviewed because it has negatively affected the quality of life, pollution of the environment, waste of natural resources and its failure to solve socio-economic problems.

In 1971, Jay Forrester of MIT published a book "World Dynamics" in which he devised a model that investigates the interplay of highly aggregated variables as world population, industrial world production, food supply, pollution and natural resources (Seldon and Song, 2004). Other related publications of the MIT are "The Limits to Growth" in 1972 and "Beyond the Limits" in 1992 (Baltimoore and Tudok, 2010). Using the "system dynamics" methodology of Forrester, the authors of Limits to Growth constructed an elaborate computer model of the world. Seldon and Song (2004) said these economists presented a large and new type of model designed to predict the future development of five global interrelated variables –population, food production, industrial production, non-renewable resources and pollution.
The model predicted that in the future population level, food production and industrial production will first grow exponentially and collapse during the 21st century. The collapse follows because the world economy will reach its physical limits in terms of non-renewable resources, agricultural land and the earth's capacity to absorb excessive pollution which are finite. According to Seldon and Song (2004), this theory posits that in the future natural resources will be exhausted and if, in addition, industrial activities continue, it will give rise to catastrophic results.

Galetotti, et al (2009) said that the Limit theory considers some vital natural minerals such as copper, gold, lead, mercury, natural gas, crude oil, silver, tin, and zinc. It suggests that future problems can be averted by controlling the growth rate of population, reducing the pollution levels, and thus achieving a global equilibrium with zero growth. The theory claims that pollution is the result of economic activities, which has an adverse effect on further growth. Thus, carbon emissions have the potentials of causing hampering economic growth through reduction in productivity.

Carbon emissions are defined as those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring, which lead to greenhouse effect. Greenhouse effect is a natural phenomenon. A natural mix of certain greenhouse gases reside in the atmosphere. They allow the short-wave radiation from the sun to penetrate the atmosphere, but absorb the lower wavelength energy which is re-radiated from the Earth's surface (Clayton, 2008). Odemba (2011) said the impact of the global shift away from fossil fuels is bound to cripple the Nigerian economy. As it stands, the Kyoto Protocol, if fully implemented, would lead to a

dramatic loss of revenue for oil-exporting countries, as a result of a heavy reduction in demand for petroleum.

Despite this huge implication of climate change response measures for Nigeria's economy, Edewan (2010) said it is appalling that there is no visible demonstration of the preparedness of the government to tackle this issue. The greatest cause for concern is that the blueprint for Nigeria's development Vision 2010 fails to give a mere acknowledgement of the importance of climate change to Nigeria's economy, let alone stipulate the development strategy with which to tackle it.

This situation, according to Asafu-Adjaye (2010), must change for Nigeria to be able to diversify its economy away from dependence on fossil fuel extraction.

Empirical Review

Some empirical studies have been carried out to assess the impact of carbon emissions and pollution on growth. Porter and Brown (2009) found out in their study that emissions from fossil fuels have a negative and significant impact on economic growth. They claimed that the negative impact is as a result of low productivity of both land and labour caused by increased carbon emissions. Though in a different study, Leo (2011) found out that there is a positive relationship between carbon emissions and growth. He said this is due to the fact that emissions result from industrial activities, which enhance growth.

Yang (2007) considers the causal relationship between different types of energy consumption and GDP in Taiwan for the period 1980–2005, which was his second major analysis. Using different types of energy consumption he found a bi-directional causality between energy and GDP. This result contradicts with Cheng (2006) who found that that there is a uni-directional causal relationship from GDP to energy use in Taiwan.

Torras and Boyce (2008) gave some causes of carbon emission. They said that economic growth leads to the emission of more carbon. This is because growth results from industrialization, which promotes the consumption of fossil fuels and natural gases. According to Sanglimsuwan (2011), population can be a driving force behind the increase in emissions. Population density is defined by mid-year population divided by land area in square kilometers. The definition of population is all residents regardless of legal status or citizenship. Land area is a country's total area, excluding area under inland water bodies.

Sanglimsuwan (2011) said that government effectiveness can positively influence on environmental quality through higher performance on good policies, and effective implementation of policies. Government effectiveness index, according to Torras and Boyce (2008), is a measure of the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies.

Mesih and Mesih (2009) found in their study that carbon emissions from gas flaring or gas fuels and solid fuels have significant impact on economic growth. A unit rise in the emissions of these fuels leads to 0.34 and 0.52 units increases in GDP, respectively. Thus, they found out that emissions have positive impact on economic growth. They added that the major sources of carbon emission in Asia are gas fuels and solid fuels. Odemba (2011) found out that carbon emission has positive and significant impact on GDP in Nigeria. A percentage

rise in emissions from cement production, bunker fuels, solid fuels, and fossil fuels leads to 0.44, 0.62, 0.56, and 0.71 units rises in real GDP, used as a proxy for growth, respectively.
Studies show that biological productivity in Nigeria will decrease in the event of global warming (Adesina and Adejuwom, 2008) with an additional consequence of severe fuelwood shortages. Already Nigeria has experienced definite shift in the long-term rainfall mean towards more arid conditions. These climatic changes have had adverse implications for water resources availability for power generation and agriculture.
The above analysis clearly suggests that it will not only be economically beneficial for Nigeria to craft a climate change-response development strategy, but that factoring climate change abatement into the overall economic development plan is also crucial for its own self-preservation. This will help to reduce the adverse effects of carbon emissions on economic growth.

Methodological Review

There are some specific econometric techniques that could be used to estimate the impact of carbon emissions on economic growth. A number of studies have shown that there exist a Granger causality links between economic growth and environmental degradation as well as energy consumption. For instance, the pioneer study by Krueger (2008) found a uni-directional Granger causality running from output to energy consumption for the United States. Nevertheless, most of the analyses on this topic have recently been conducted using Vector Autoregression (VAR) models.

Essien (2011) said the Standard Granger test is widely used as a convenient method for investigating the causal relationship between two variables. This test states that, if past values of a variable Y significantly contribute to forecast the value of another variable Xt+1 then Y is said to Granger cause X and vice versa.

However, most empirical analyses on the impact of carbon emissions on growth are based on least squares techniques. Commonly used are the OLS and Two-stage-Least-Least (2SLS) estimators. The difference between both techniques is the use of an instrumental variable or proxy in 2SLS to avoid multicollinearity problem if any in the model. The instrumental variable must be highly correlated with the variable causing the multicollinearity problem and must not be correlated with any other variable in the model.

METHODOLOGY/THEORETICAL FRAMEWORK

In this section, the various methods employed in this paper and the theoretical framework are discussed. This is done under the following sub-headings: Theoretical Framework; and Model Specification, Description of Variables; Source and Nature of Data and Method of Analysis.

Theoretical Framework of the Study

Several models have been formulated to measure the impact of pollution on growth and vice versa. The characteristics of production and abatement technology, and of preferences and their evolution with income growth, underlie the shape of the income environment relationship. As far as this paper is concerned, the researcher adopted the work of Batimoore and Tudok (2010) to form the theoretical framework. According to Batimoore and Tudok (2010), using Forster'sgrowth and pollution model with a utility function that is additively

separable between consumption and pollution, derive an inverted-U path for pollution and a J-curve for abatement that starts when a given capital stock is achieved; that is, expenditure on pollution abatement is zero until "development has created enough consumption and enough environmental damage to merit expenditures on abatement".

However, emphasizing on the pollution-growth relationship, Forster'sgrowth and pollution model assesses some major factors.Batimoore and Tudok (2010) said three major factors are considered in this model. These include large direct effects of pollution on growth, high technology side which enhances growth, and rapidly inclining marginal utility of consumption which puts more pressure on industrial production. This model could be stated explicitly as follows:

$GDP = \alpha_0 + \alpha_1 POL + \alpha_2 TCH + \alpha_3 CON + \varepsilon_i$ ----------1

According to Batimoore and Tudok (2010), pollution has negative effect on growth, while technology and consumption have positive effects on growth. Even when pollution or carbon emissions would be expected to have negative effect on GDP, empirical studies have shown that the signs may be positive. Batimoore and Tudok (2010) said the shocking positive sign of pollution in some studies is due to the output generated during carbon emissions or pollution, which contribute positively to growth. Increase in carbon emissions implies that there is a rise in industrial activities which generate the pollution, which in turn leads to increase in growth.

Model Specification

A multiple regression model is specified in this research work to assess the impact of carbon emissions from five major sources on economic growth. This is specified implicitly as follows:

GDP = f (FOF, GAF, LIF, SOF, CEP) ----------2

Linearizing the above growth model and stating it in explicit form, we will have :

$GDP = \alpha_0 + \alpha_1 FOF_t + \alpha_2 GAF_t + \alpha_3 LIF_t + \alpha_4 SOF_t + \alpha_5 CEP_t + U_t$----------3

Where,

$\alpha_1 < 0, \alpha_2 < 0, \alpha_3 < 0, \alpha_4 < 0$, and $\alpha_5 < 0$

Emissions from carbon have negative impact on economic growth. Despite the fact that increase in carbon emissions implies that there is either increase in consumption or production activities which has a positive impact on growth, carbon emissions affect health of workers, reduces productivity of both labour and land.

Description of Variables

From the model specified above, some specific variables are used in the study, whichare described below. The expected signs of the explanatory variables on gross domestic product (GDP) are also discussed briefly.

GDP = Gross Domestic product
FOF = Emissions from Fossils Fuels (-)
GAF = Emissions from Gas Fuels (-)
LIF = Emissions from Liquid Fuels (-)
SOF = Emissions from Solid Fuels (-)
CEP = Emissions from Cement Production (-)

Source and Nature of Data

The data used in the study are mainly secondary in nature. The major sources are CBN statistical bulletin and Carbon Dioxide Information Analysis Center annual publication. While data on GDP are obtained from CBN statistical bulletin, data on carbon emissions are gathered from the Center for Carbon Dioxide Information Analysis annual publication and International Energy Agency.

Method of Analysis

The methods employed in the study are, therefore, both theoretical and empirical. Existing literature and empirical researches on the topic were reviewed. The method of data collection depends largely on secondary sources. This is because of their accessibility and applicability in empirical analysis. The method of data analysis is the ordinary least squares (OLS) technique. The OLS has certain optimal properties, as stated above, which make it the best in the class of linear estimators. For the statistical test of the model, the standard error test, t-test, co-efficient of determination and F-test will be used to test the significance of the explanatory variables; while the Durbin-Watson (DW) statistic will be used for the econometric test of the model, if there is evidence of autocorrelation or not in the model.

ANALYSIS OF RESULT

The results obtained from the data analyzed are presented as follows:

Dependent Variable: LGDP
Method: Least squares
Sample: 1980 – 2010
Included Observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGAF	-0.4543	0.1670	-2.71	0.0105
LFOF	-0.0806	0.0269	-2.98	0.0053
LCEP	-0.7099	0.1096	-6.47	0.0000
LLIF	-0.1038	0.0306	-3.38	0.0019
LSOS	-0.0197	0.0607	-0.32	0.7483
C	0.8393	7.9368	0.10	0.9166
R-Squared:			0.80	
Adjusted R-Squared			0.79	
F-Statistic:			111.67	
DW-Statistic:			2.13	

Interpretation of Result

Three major criteria are used in interpreting the results. These are:Economic / a priori Criteria;Statistical criteria; and Econometric criteria

Economic / a priori Criteria

These criteria are based on the signs and sizes of the estimated parameters of the model in relation to economic theory. The estimated results above show that carbon emissions have negative impact on gross domestic product (GDP) in Nigeria. A unit rise in gas fuel emissions, fossil fuel emissions, cement production emissions, liquid fuel emissions, and solid fuel emissions will lead to 0.45, 0.08, 0.70, 0.10, and 0.01 units decline in GDP,

respectively. It should be noted that the signs of the estimated parameters fulfill their a priori expectations, since carbon emissions have adverse effect on economic growth in Nigeria.

Statistical Criteria

These criteria include the standard error test, the t-statistic, the coefficient of determination (or R-Squared), and the F-statistic.
Using the rule of thumb, the standard error values of gas fuel emissions (0.16), fossil fuel emissions (0.02), cement emissions (0.10), and liquid fuel emissions (0.03) are less than the valuesof half their respective coefficients which are 0.22, 0.04, 0.35 and 0.05 in absolute terms. This implies that emission from gas fuels, fossil fuels, cement production and liquid fuels have significant impact on economic growth in Nigeria (Proxied by GDP).

However, the standard error value of solid fuel emissions (0.06) is greater than the value of half its coefficient (0.009) is absolute terms. This implies that emissions from solid fuels do not have significant impact on economic growth in Nigeria.

Similarly, the t-statistics for gas fuel emissions (2.71), fossil fuel emissions (2.98), cement production emissions (6.47), and liquid fuel emissions (3.38), which are given in absolute terms, are greater than the t-critical value (1.70), at the 5% level of significance, this further shows that emissions from gas fuels, fossil fuels, cement production and liquid fuels have significant impact on economic growth in Nigeria. This verifies the findings of the standard error test.

The calculated t- statistic for solid fuel emissions (0.32), in absolute terms also, is, however, less than the t-critical value (1.70), at the 5% level of significance. This implies that emissions from solid fuels do not have significant impact on economic growth in the country.

Furthermore, the coefficient of determination (or R-squared) is 0.80, which indicates that 80% of the systematic variations in economic growth (proxied by GDP) is explained by carbon emissions in the country. The F – statistic (111.67), which is used in testing the overall significance of the explanatory variables, is greater than the f-critical value (2.60), at the 5% level of significance. This implies that the overall fitness of the model is good.

Econometric Criteria

These criteria are based on the Durbin –Watson statistic. From the estimated models above, the Durbin – Watson statistic is 2.13. Using the rule of thumb, since this value is approximately 2.00, there is absence of auto correlation (or first order serial correlation) in the model. In other words, the value which the stochastic disturbance term assumed in any one period is independent of its previous values.

Discussion of Findings

From the results presented and interpreted above, some findings are made in the study which are discussed below. First, the study reveals that carbon emissions have negative impact on economic growth in Nigeria. They have adverse effect on the level of gross domestic product (GDP) through reduction in aggregate output in the Nigerian economy. Second, the study reveals that all sources of carbon emissions in Nigeria except solid fuels, have significant impact on the levels of economic growth. For instance, the unit rise in gas fuel emissions

leads to 0.45 unit decline in GDP, and a unit rise in cement production emissions leads to 0.70 unit decline in GDP.

However, emissions from solid fuels appear to be insignificant. The quality of carbons flared from solid fuels are not as consistent as those of other sources of emissions. This reduces the impact of emissions from this source on GDP in Nigeria. For instance, a unit rise in emissions from solid fuels will lead to 0.01 unit fall in GDP.

Policy Implications of Findings

From the findings discussed above, some necessary policy implications could be stated as follows:

i. Emissions of carbon have adverse effect on economic growth in Nigeria. They reduce the level of aggregate output in the economy.
ii. All the various sources of carbon emissions in Nigeria have significant impact on gross domestic product (GDP), except emissions from solid fuels.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, some conclusions could be drawn. Carbon emissions have negative impact on gross domestic product in Nigeria. This is because emissions of carbon reduce productivity and output, which in turn adversely affect economic growth.Nigeria has been listed among the nations with the highest rates of gas flares in the world. This has led to a high amount of emitted carbon in the atmosphere, thereby hampering productivity and growth.

There is high rate of carbon emissions in Nigeria than what is presently given in papers. The study has shown that cement production is rapidly becoming a major source of carbon emissions in the country. Also, the liberalization of trade in the country has encouraged the importation of vehicles, especially fairly used cars. Car fumes, as a result, have increased in large metric tonnes causing environmental hazards. Other sources of carbon emissions include fumes from plants and small power generators, which are also imported in large quantities due to inconsistent supply of electricity in the country.

The suggestion that oil-producing countries should be compensated for their projected income losses in the event of the implementation of the Kyoto protocol and assisted in their economy diversification attempt should be vigorously argued and canvassed. Nigeria can only be sure that its interest is protected in the emergent global abatement strategy if it increases its level of participation. Its participatory capacity in turn will be enhanced by findings from studies and research into various ramifications and dimensions of the climate change issue as suggested above.

However, the research has demonstrated that Nigeria cannot afford to continue ignoring the potential impacts of the global climate change response measures on its oil-based economy. It was also made clear that though Nigeria should capitalize on the emission headroom afforded it for its low historical contribution to the climate change problem, it is in its interest to begin to introduce measures to reduce its greenhouse gas emissions, due to the negative impacts of climate change on its economic, social and environmental resources.

Study on carbon emissions and its economic impacts on Nigeria are very important for creating awareness and providing the background information for targeting policies adequately. This point is made in view of the recognition that the major constraint to adequate forecasting and formulation of adaptation policies is the paucity of climate data in Nigeria. Based on the conclusions drawn above, some vital recommendations are stated in terms of policies for remedying the negative impact of carbon emissions in Nigeria. In order to enhance the pace of economic growth in the country, there should be reduction in the quantities of carbon emitted daily. This can be done through concerted effort by both the government and oil multinational firms in the country.

REFERENCES

Adesina, F.A and Adejuwon, J.O., (2008). Climate Change And Potential Impact On Biomass Energy Production In Nigeria. A Preliminary Assessment. Paperpresented At The International Workshop On The Impact Of Global Climate Change On Energy Development, Lagos, Nigeria, March 28-30.

Baltimoore, C and Tudok, R., (2010). Relationships Between Energy And GNP. *Journal Of Energy And Development*, Vol 3, pp. 401-403.

Clayton, K. (2008) The threat of global warming. In O'Riordan, T (ed.) *Environmental science for environmental management*. England: Longman Group Ltd. Pp. 110-130

Essien, L.P.E., (2008). Oil Spill Management in Nigeria: Challenges of Pipeline Vandalism in the Niger Delta Region of Nigeria. In Proc.Int.Petr.Envr.Conf., 2008.

Galeotti, M., Manera, M. and Lanza, A. (2009). On the robustness of robustness checks of the Environmental Kuznets Curve, *Environmental and Resource Economics*, 42, 551-574

Garber, P. M. (2011).The Effect of Industrialization on the Environment. Cambridge: MIT Press.

Grossman, G. M. (2009). Economic Growth and the Environment.*The QuarterlyJournal of Economics* ,110, 353-377.

Kaufmann, D., Kraay, A., &Mastruzzi, M. (2007).*Governance Matters VI:Governance Indicators for 1996-2006.* Washington DC: World Bank Policy Research Working Paper .

Krueger, A. O. (2008). *Environmental impacts of a North American Free Trade Agreement.* Cambridge: National Buerau of Economic Research Working Paper.

Mesih, R.A and Mesih,T., (2009). Causality Between Income and Emission: A Country Group Specific Econometric Analysis, Ecological Economics, Vol 40. Pp. 351-367.

Moore, M., Gould, P., and Keary, B. (2008).Global urbanization and impact on health.*International Journal of Hygiene and Environmental Health* , 269-278.

Porter, A. and Brown, H.J., (2009). Energy Consumption, Economic Growth and Prices; A Reassessment using Panel VECM for Developed and Developing Countries, *Energy Policy.*Vol.35, pp. 2481-2490.

SanglimsuwanK.S (2011). Carbon Dioxide Emissions and Economic Growth: An Econometric Analysis International Research Journal of Finance and Economics. ISSN 1450 – 2887, Issue 67. BumJournal publishing Inc.

Seldon, T., and Song, D. (2004). Environmental quality and development: Is there a kuznet curve for air pollution emissions? *Journal of Environmental Economics and Management*, 147-162.

Shafik, N.(2002). *Economic growth and environmental quality: Time series and Cross-country evidence.* Policy Research Working Paper Series 904, The World Bank.

Stern, D. (2009). Economic Growth and Environmental Degradation: the Environmental Kuznets Curve and Sustainable Development, *World Development*, 24, 1151-1160.

Torras, M., & Boyce, J. K. (2008). Income, inequality, and pollution: Reassessment of the Environmental Kuznets Curve. *Ecological Economics*, 147-160.