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Economic Growth, Air Pollution Standards Enforcement and Employment Generation Nexus in the Nigerian Context

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Abstract:
Contrary to theoretical expectation, available data show a positive correlation between economic growth and unemployment in Nigeria between 2000 and 2014 (WDI, 2015). At 7.87 percent average annual growth rate from 2000 to 2014, Nigeria's economic performance could be classified as a growth miracle. This impressive performance resulted in more than eight-fold increase in the country's gross domestic product (GDP) per capita($377 in 2000 to $3184 in 2014). In spite of this performance unemployment rate in the country has continued to soar. Overall unemployment rate increased persistently from 12.3 percent in 2006 to 23.9 percent in 2011. Youth unemployment has remained consistently high at over 13 percent since 2000. This is an indication of non-inclusive growth. Economic growth is associated with a variety of costs such as pollution and environmental degradation. An ineffective regulation of firms' productive activities and household consumption has a chain effect on sustainable economic growth. For instance, increased output in Nigeria will result in an increase in carbon monoxide emission. The health effect of carbon monoxide (CO) has two adverse economic implications: first, the health effect of CO could lead to loss of productivity and death; secondly, it leads to higher expenditure on health, lower savings and eventually lower investment. An effective enforcement of existing environmental and air pollution rules could serve the dual purpose of engendering both inclusive and sustainable economic growth. Thus, the paper presents a dynamic model that explains the relationship among economic growth, air pollution standards enforcement and employment generation.

Keywords: *Economic growth, air pollution, standards enforcement, employment, employment*

1. Introduction

Contrary to theoretical expectation, available data show a positive correlation between economic growth and unemployment in Nigeria between 2000 and 2014 (WDI, 2015). At 7.87 percent average annual growth rate from 2000 to 2014, Nigeria's economic performance could be classified as a growth miracle. This impressive performance resulted in more than eight-fold increase in the country's gross domestic product (GDP) per capita ($377 in 2000 to $3184 in 2014). In spite of this performance unemployment rate in the country has continued to soar. Overall unemployment rate increased persistently from 12.3 percent in 2006 to 23.9 percent in 2011. Youth unemployment has remained consistently high at over 13 percent since 2000. This is an indication of non-inclusive growth.

Economic growth is expected to result in several social and economic benefits: these include reduction in poverty, inequality and environmental degradation, as well as increase in education, health, welfare, employment and income. On the other hand, both economic activities and consumption pattern result in costs that could affect inclusive growth and sustainable development. For instance, increased output in Nigeria will result in an increase in carbon monoxide emission. The health effect of carbon monoxide (CO) has two adverse economic implications: first, the health effect of CO could lead to loss of productivity and death; secondly, it leads to higher expenditure on health, lower savings and eventually lower investment which could affect future economic growth.

An effective enforcement of existing environmental and air pollution rules could serve the dual purpose of engendering both inclusive and sustainable economic growth. Thus, this study examines the dynamic relationship between economic growth, air pollution standards enforcement and employment generation in Nigeria.

The overall objective of this study is to outline the critical relationship between economic growth and the environment and to use the knowledge to make better and wiser decisions that will engender inclusive economic growth.

Specifically, this study will address the following objectives:

- To ascertain the correlation between economic growth and air pollution in Nigeria.

- To compare World Health Organization (WHO) air pollution standards with the level in Nigeria.
- To identify various guidelines, laws and agencies responsible for the control of air pollution in Nigeria
- To evaluate the effect of these measures in controlling air pollution in Nigeria.
- To demonstrate how an effective enforcement of air pollution guidelines and laws could lead to job creation and sustainable economic growth.

The study will make use of tables, charts, correlation and an analytical framework to achieve the objectives listed above.
The outcome of the study will reveal the efficacy of specific measures employed by the Nigerian government to control air pollution. It will also show how inclusive and sustainable growth can be achieved through the use of government policy and strengthening of institutions.
To achieve the objective stated above, the remaining part of this study is organized into four parts. Section two examines the growth experience of Nigeria and the associated pollution from 2000 to 2014. The third section highlights and examines the effects of the various regulatory agencies in Nigeria. This is done by comparing the level of air pollution in Nigeria with world standards. The health incidents of air pollution will also be used to gauge the efficacy of the regulatory agencies. Section four presents a demonstration of the dynamic relationship among economic growth, air pollution standards enforcement and employment generation. Section five concludes the study.

2. Economic Growth and Pollution in Nigeria

Callan and Thomas (2013) noted that the fundamental decisions that comprise economic activity are directly connected to environmental problems. They demonstrated this using the 'materials balance model' (MBM). The model shows how raw materials entering the system eventually are released back to nature as by-products or residuals.
Most residuals are in form of gases. Some are not harmful in small quantity. In fact, some are absorbed or neutralized naturally through a process known as the 'assimilative capacity' of the environment. An example is carbon dioxide emissions from the combustion of fossil fuels (i.e., oil, coal, and natural gas). Other released gases are not easily assimilated and may cause harm, even in the short term.
There are also liquid residuals, such as industrial wastewaters, and solid residuals such as municipal trash and other hazardous wastes. All these are potential threats to health and the ecology. The MBM shows that though it is possible to delay the flow of residual (through recovery, recycling and reuse) back to nature, it cannot be prevented.

2.1. Air Pollution

Environmental sustainability is a topical issue around the globe and specifically promoting air quality standard is a major thrust of that discourse. Air pollution has been severally defined. It has been define as the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem that is physical system or living organisms (Akande, Ajaka, Omosogbe, and Lawal, 2013:82). In other words, it is the prevalent of harmful substance in the atmosphere which is detriment to health and wellbeing of people, animal and the environment. According to the United State Environmental Protection Agency 1994 "it is also the contamination of air by discharge of harmful substances, which can cause health problems including burning eyes and nose, itchy irritated throat and breathing problems (cited from Ndoke & Jimoh, 2005:222). World Health Organization, 2012 defines Air pollution as contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere (WHO, 2012). Thus air pollution constitutes a form of pollution that makes air or atmosphere detrimental to public health and wellbeing.

2.2. Types of Air Pollution in Nigeria

Classification of air pollutant is a difficult project in developing countries compared to developed countries as there are no documents from environmental agency that oversea pollution issues to attempt a classification and codification of pollutant. However, types of pollutant are done according to several parameters among which include chemical composition, primary or secondary pollutant, natural or man-made pollutant, space or scale of their effect (that is whether their effect is local, national or global), physical state of the pollutant (that is Gaseous, Liquid (aqueous) or Solid) (Ukemenam, 2014:294-295). Globally, it has been observed that the highest number of pollutant comes from transport sector of the economy and particularly from vehicular emission coming from used cars. It has been estimated that if the rate of ownership of individual automobiles continues to increase, 30 years from now, in the year 2042 AD, 9 out of every 10 citizens will own a car which then means that pollution by automobiles will triple. (Okere, Nwachukwu & Ezebuiro 2013:10). Air pollutants associated with traffic-related emissions such as nitrogen oxides (NOx), carbon monoxide (CO) and particulates (PM10) have been recognized to have significant impact on human health with evidence suggesting causal associations between elevated PM10 and mortality (Ojo & Awokola 2012:31)

2.3. Causes, Sources and Scope of Environmental Damage

Substances that cause environmental pollution could be natural or anthropogenic (i.e. from human activities). Natural cause of pollution comes from pollen, dust particle from volcanic disturbance, gases from decaying animals and plants even salt spray from the oceans (Callan &Thomas 2013 :206). Anthropogenic activities that lead to pollution comes from vehicle exhaust aggravated by the rising car population, industrial emission especially from petrochemical industries and cement manufacture, use of gasoline generation as a result of unstable power supply, use of fuel wood for domestic use and energy for small industries (Ladan,2013:621). Pollution is also cause by indiscriminate dumping of solid waste which decomposes to a number of gases that are present in the exposed solid

waste including ammonia (NH3), carbon dioxide (CO2) Carbon monoxide (CO), Hydrogen H2, Hydrogen Sulphide (H5S), Methane (CH4), Nitrogen (N2) (Otti&Ogbuagu 2014: 81)

Polluting sources are many, ranging from automobiles to waste disposal sites. Depending on the environmental media (air, water or land), sources of pollution are generally grouped into i) their mobility (stationary or mobile source) and ii) their identifiability (point or non-point source).

Some types of pollution have detrimental effects that are limited to a single community. Others pose a risk over a large geographic region. Generally, the scope is divided into three. I) Local pollution refers to environmental damage that does not extend far from the polluting source. An example is urban smog, solid waste pollution. Poor waste management practices can allow contaminants such as lead and mercury to leach into soil and water supplies; ii) regional pollution are environmental pollution that poses a risk well beyond the polluting source. An example is acidic deposition. This is commonly known as acid rain. It is called regional pollution because the harmful emissions can travel hundreds of miles from their source. Another example is oil spill; iii) examples of global pollution are global warming (greenhouse effect)

Real GDP has experienced tremendous growth in Nigeria especially since the beginning of the present democratic regime. Although total carbon monoxide emission has been fluctuating, an upward trend was observed. This has resulted in a correlation coefficient of 0.75 between 1960 and 2010. Available data (Appendix 1) shows that the 7.87 per cent average growth rate experienced between 2000 and 2014 led to doubling of RGDP from N25,647 billion in 2002 to N55,469 billion in 2010. This, no doubt could be classified as a growth miracle. Another interesting observation is the decline in CO2 emission from 104,697 kt in 2005 to 78,910 Kt in 2010. This confirms Kuznets hypothesis. However, this tremendous growth performance has not had the desired effect on unemployment and poverty. If specific and innovative measures are not taken to address these issues, the resulting effect could affect the sustained growth already achieved.

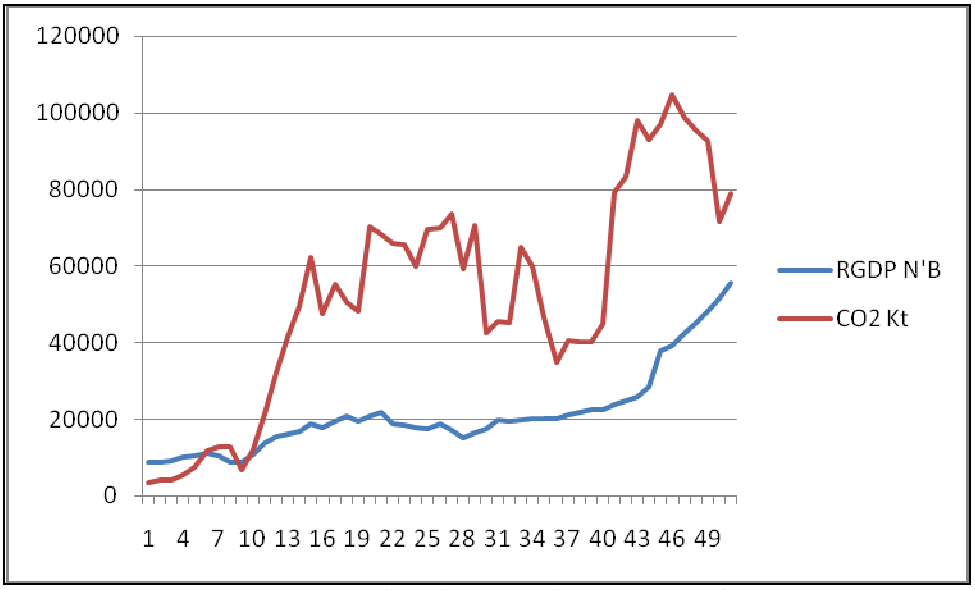

Figure 1: RGDP and Carbon Dioxide Emission. 1960 - 2010
Source: World Bank, World Development Indicators, 2015

2.4. Effect of Air Pollution in Nigeria

The effect of air pollution is widespread affecting man, animal, vegetation and the environment. The implication of air pollution on the health of man is numerous. The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution, with 1.5 million of these deaths attributable to indoor air pollution (Magaji& Hassan, 2015:88). Studies reveal that air pollution increase the incidence of cancer, birth defects, brain and nerve damage, and long-term injury to the lungs and evendeath (Ndoke&Jimoh, 2005:222). Air pollution causes chronic respiratory diseases especially asthma, chronic bronchitis and lung emphysema (Otti, & Ogbuagu,2014:82) Other effect of air pollution include low birth weight and nutritional deficiency in children; interstitial lung disease, chronic obstructive lung disease, tuberculosis, cardiovascular disease and cataract among others in adults (Ukemenam, 2014:302-303)

In a study of the effect of air pollution on the people of Rivers State, using data collected from state ministry of health, the study reveal that a total number of 30,435 disease cases were reported during 2003 to 2008, out of which 61 patients died. The diseases found to be prevalent in the study area as a result of air pollution were pertussis, pulmonary tuberculosis, cerebrospinal meningitis (CSM), pneumonia, measles, chronic bronchitis, and upper respiratory tract infection (URT) (Nwachukwu, Chukwuocha, &Igbudu, 2012: 373-374). Another study by WHO's International Agency for Research on Cancer (IARC) observe that air pollution is carcinogenic to humans, with the particulate matter component of air pollution most closely associated with increased cancer incidence, especially cancer of the lung(WHO, 2014, Sharma, Jain, Khirwadkar, & Kulkarni, 2013:394-395).

3. Environmental Regulatory Agencies in Nigement

3.1. Guidelines, Laws and Agencies

The need to control air pollution and have quality air for people is a global concern and as such been the thrust of many international and regional legal frameworks on environmental sustainability. Reducing atmospheric concentration of harmful substance has been the concern of global organization like the UN and has such has several protocol, convention and legal framework seeking to control the concentration of certain pollutant in the air specifically those that deplete the ozone layer and causes global climate change . Also developed countries of the world such as the United states has strict environmental laws that control air quality most popular being the Clean Air Act of 1990 which has since been revised by successive administration . Beside the laws of UN and develop countries like US, there has also been market –based approaches to controlling air pollution such as the Tradeable Permits (Allowances), Tradeable Permits (Credits) and Carbon/CO2 Emissions Tax. These approaches proposed, promoted and adopted by some developed countries aims to make reduction of greenhouse gas profitable by giving same incentives to countries and companies that reduce emission and threat of punishment to those that violate same.

Similarly, the World Health Organization provides air quality guideline. The WHO air quality guidelines are designed to offer guidance in reducing the health impacts of air pollution. Below is the air quality guideline for particulate matter, Ozone, sulfur dioxide, Nitrogen dioxide and carbon monoxide

World Health Organization (WHO) air quality guidelines	
Particulate matter with a diameter of 2.5 μm or less ($PM_{2.5}$)	10 μg/m^3 (annual mean) 25 μg/m^3 (24 h mean)
Particulate matter with a diameter of 10 μm or less (PM_{10})	20 μg/m^3 (annual mean) 50 μg/m^3 (24 h mean)
Ozone	100 μg/m^3 (8 h mean)
Nitrogen dioxide	40 μg/m^3 (annual mean) 200 μg/m^3 (1 h mean)
Sulfur dioxide	20 μg/m^3 (24 h mean) 500 μg/m^3 (10 min mean)
Carbon monoxide	60 mg/m^3 (30 min mean) 30 mg/m^3 (1 h mean) 10 mg/m^3 (8 h mean)

Table 1: WHO Air Quality Guidelines
Source: WHO, 2006

In Nigeria, there are several laws, regulation and agencies dealing with different aspect of environmental issues from the national, state and local government level. Federal Military Government under Decree 58 of 30 December 1988 established the Federal Environmental Protection Agency with statutory responsibility for overall protection of the environment and setting and enforcing ambient and emission standards for air, water and noise pollution. Specifically on air quality, the agency has the following among other responsibility

1. Establish more criteria, guidelines, specifications and standards to protect and enhance the quality of Nigeria's air resources so as to promote the public health or welfare and the normal development and productive capacity of the nation's human, animal or plant life, and include in particular-
2. the control of concentration of substances in the air which separately or in combination are likely to result in damage or deterioration of property or of human, animal or plant health;
3. develop the most appropriate means to prevent and combat various forms of atmospheric pollution;
4. controls for atmospheric pollution originating from energy sources, including that produced by aircraft and other self-propelled vehicles and in factories and power generation stations;
5. develop standards applicable to emission from any new mobile source which in the Agency's judgement causes or contributes to air pollution which may reasonably be anticipated to endanger public health or welfare.

In line with the mandate of the agency, FEPA has since developed permissible limit on certain pollutant. Below is a Federal Environmental Protection Agency (FEPA limit on certain pollutant

S/N	Pollutant	Limit
1	Particulate matter(mg/m^3)	0.25
2.	Carbon monoxide (ppm)	10
3.	Sulphur dioxide	0.01
4.	Ammonia (NH_3)	0.30
5.	Nitrogen dioxide (ppm)	0.06
6.	Chlorine(CL_2)	0.01
7.	Hydrogen cyanide (Hcn)	1

Table 2: Air Pollutant Standards in Nigeria
Source :(Magaji& Hassan 2015:90)

However, in spite of the laws, the inability to enforce the laws of FEPA and several loopholes in regulation and enforcement of environmental laws lead to the establishment of National Environmental standards and regulations Enforcement Agency in line with section 20 of the 1999 Constitution of the Federal Republic of Nigeria, The National Environmental Standards and Regulations Enforcement Agency Act 2007 repealed the Federal Environmental Protection Agency Act Cap F 10 LFN 2004. National environmental Regulation and Enforcement Agency (NESREA) has since then developed the twenty four (24) Environmental Regulations. One of the regulation is the National Environmental **(Control of Vehicular Emissions from Petrol and Diesel Engines)** Regulations, 2010. S. I. No. 20. The purpose of this regulation is to restore, preserve and improve the quality of air.

Besides, the regulation on control of vehicular emission from petrol and diesel engine, the Agency also have other initiative and programs to control environment degradation. This include :The toxic waste dump watch programme which comprises of the following government organizations : the Nigerian Navy; State Security Service; National Intelligence Agency; Defense Intelligence Agency; the Nigeria Customs Service; Nigeria Ports Authority; Nigeria Maritime Administration and Safety Agency with the sole aim of monitoring the clandestine movement and influx of hazardous chemicals and wastes, including non-serviceable second-hand goods (especially electrical and electronics equipment) into Nigeria (Benebo 2011: 545) At the state level, almost all of the 36 state in Nigeria have one department or the other committed to promoting environmental issues. In Lagos state Environmental protection Agency which deals with issues of air and noise pollution among others.

Fundamentally, in spite of the presences of regulation Omofonmwan & Osa-Edoh (2008) observed that the rate of environmental degradation is growing worse than what it was before the establishment of FEPA as all form of environmental pollution and degradation still persist (Omofonmwan&Osa-Edoh 2008:56). The growing laxity in enforcing air pollution law can be attributed to a numerous cause. First is the lack of governmental will to enforce beyond lip service international laws and standard on air quality control and enforce strict laws on the importation of vehicle that meet the standard of policy set. The Nigeria government has not set standard on the quality of vehicle and energy generating equipment such as generator imported into the country as many of them did not meet health and safety standard. Secondly, In Nigeria, there is neither a legislative framework nor a set standard to monitor emission from mobile source(Abam & Unachukwu, 2009:555) The regulatory framework put in place by government through FEPA is limited to emission generated through stationary source. The implication is that there is no measuring standard through which erring motorist can be apprehended and as such be penalize

3.2. Standard vs Reality

While WHO, FEPA AND NASREA have standard limit on permissible pollutant numerous studies shows that current air condition across several cities and towns of Nigeria violate this limit. In a study on the level of concentration of vehicular emissions in selected areas in Calabar reveals that the air pollution indicators for CO was: 8.7ppm, 7.6ppm and 7.4ppm and the concentration of SO2 was highest with values 0.10ppm and 0.12ppmwhich was above the permissible limit of USEPA ambient air quality standards (Abam & Unachukwu, 2009:555-558). In a study of the concentrations of carbon oxides (CO and CO_2) and suspended particulate matter at Benue Cement Company (BCC) and Tse-Kucha community, shows that the concentrations of suspended particulate matter of 375 $\mu g/m^3$, 338 $\mu g/m^3$ and 290 $\mu g/m^3$ at the cement mill, packing house and raw mill respectively were above the World Health Organization's (WHO's) Guidelines and Standards for Ambient Air Quality which stipulates a range of 150 $\mu g/m^3$ to 230 $\mu g/m^3$ for a 24- hourly average (Abdulkarim, Chiroma, & Joseph, 2007:109-116).

4. Dynamic Relationship among Economic Growth, Air Pollution Standards Enforcement and Employment Generation

The environmental reality on ground which indicates the inefficiency the various regulatory agencies, coupled with rising unemployment rate in the context of a growing economy calls for an innovative approach to solve the problem of non-inclusive growth and impending unsustainable economic development.

The model below presents a vivid illustration of how government can enhance the efficiency of the environmental standards enforcement agencies through an increase in government expenditure to the agencies. The increased allocation should be used essentially to engage more workers to effectively enforce existing laws. It is important to note that in view of the peculiarity of Nigerian workers, other institutions such as zero tolerance to corruption should also be pursued.

Effective enforcement of environmental laws such as that on emission of carbon monoxide from cars which lead to compliance, which in turn lead to demand – led employment generation.

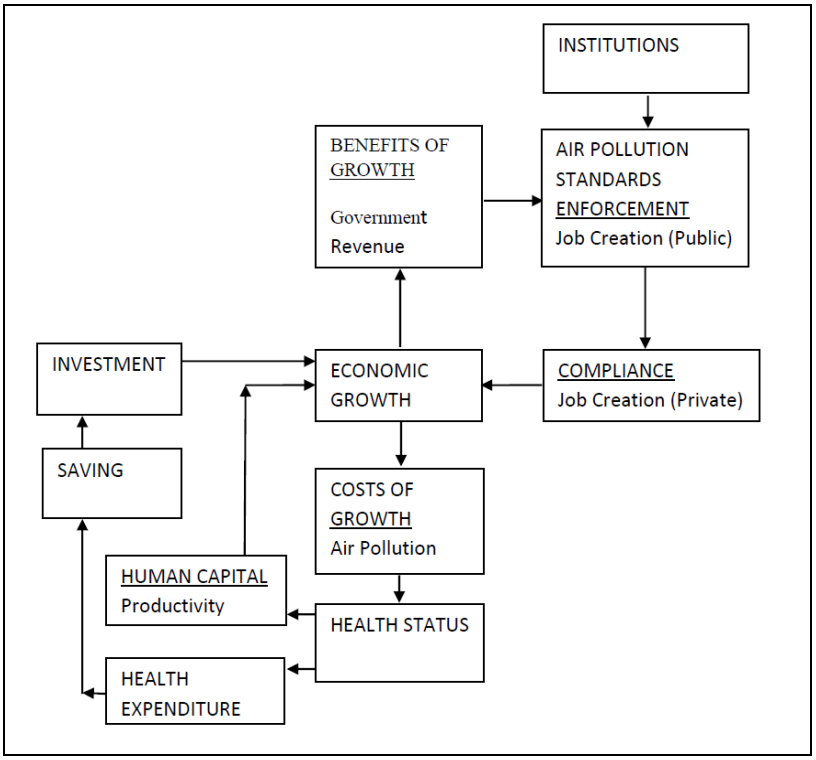

Figure2: Dynamic Relationship among Economic Growth, Government Policy and Employment Generation
Source: Authors' Design

The model above represents both a virtuous cycle of inclusive and sustainable growth and a vicious cycle of non-inclusive and unsustainable growth. The upper right loop is made possible by effective and efficient pollution standards enforcement, while the lower left loop is the result of an ineffective enforcement mechanism.

5. Concluding Remarks

From observation, Nigerians are very good at obeying laid down rules in the face of an impartial enforcement agency. The challenge with the Nigerian economy is not the absence of appropriate law, rather it is the challenge of effective and efficient enforcement mechanism. If adopted, this could be another form of public private partnership (PPP). A situation where government intervention stimulates private sector employment generation through demand – led supply.

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Appendix 1

YEAR	RGDP N'B	CO2 Kt
1960	8819	3407
1961	8836	4114
1962	9198	4180
1963	9988	5350
1964	10482	7275
1965	10994	11764
1966	10527	12908
1967	8869	12838
1968	8759	6634
1969	10878	12112
1970	13598	21540
1971	15535	32281
1972	16057	41426
1973	16923	49578
1974	18812	62291
1975	17828	47396
1976	19440	55247
1977	20612	50568
1978	19423	48294
1979	20736	70289
1980	21608	68155
1981	18772	65958
1982	18574	65603
1983	17636	59930
1984	17279	69625
1985	18717	69893
1986	17079	73505
1987	15243	59343
1988	16392	70747
1989	17452	42442
1990	19680	45375
1991	19559	45247
1992	19644	64884
1993	20054	60062
1994	20237	46659
1995	20174	34917
1996	21182	40421
1997	21776	40190
1998	22367	40183
1999	22473	44789
2000	23668	79182
2001	24712	83351
2002	25647	98125
2003	28303	93138
2004	37851	97047
2005	39155	104697
2006	42370	98514
2007	45263	95210
2008	48101	92621
2009	51437	71719
2010	55469	78910

Source: World Bank, World Development Indicators, 2015

APPENDIX 2: Correlation between RGDP and CO2

	RGDP	CO2		
RGDP	1	0.749916		
CO2	0.749916	1		

Source: World Bank, World Development Indicators, 2015