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INDUSTRIAL ACTIVITY AND ENVIRONMENTAL POLLUTION: A PANEL DATA ANALYSIS

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ABSTRACT: *Can good environmental policy and planning reduce the negative external consequence that industrial activity can cause, to the environment? To what extent is the current level of industrial activity causing environmental degradation and affecting regional ecological environment across? Industrialization in many developing and developed countries is often associated with negative environmental consequences such as noise pollution, air pollution, water bed pollution and land degradation. Industrial waste and waste attributable to consumables from industrial final products also accounts for more than 65 Percent of all known waste worldwide IEA Report 2013. This study investigates the effect of regional Industrial Activity on environmental pollution using data from six regions worldwide. It was found that industrial activity were a principal causative agent of environment pollution and it is suggested that strategic planning and good policies to mitigate environmental pollution should be strengthened.*

KEYWORDS: Industrial Activity, Environmental Pollution, Energy, Entrepreneurial Innovation, Panel Data and Quantitative Economics.

JEL Classification: C5 and Q4

INTRODUCTION

Background of the Study

In this section a brief introduction into the study is made. The relationship between industrial activity and environmental pollution has remained an intrinsic matter in the debate on climate change and pollution in general. Increases in entrepreneurial activities has led to increases in growth and eventual increases in human driven waste into the environment. Lots of studies have examined the relationship between climate change and emissions and others have also examined the relationship between industrialization and climate change. The relationship between industrial activities such as manufacturing, mining and other agricultural practices on environmental pollution through industrial discharges and other agro-chemicals used in agricultural practices that often have strong consequences for the environment have largely be under researched.The question if good environmental practices and planning can reduce the negative externalities associated with industrial activities has also been largely neglected, the extent to which negative industrial practices impact environmental harmony and livelihood is also a matter of concern for governments.

Prior to 2002, the incremental annual increase had never reached 1 billion new metric tons of carbon dioxide, after 2002 however, 1 billion incremental tons have been added three times (see 2003, 2004, and 2010 EPA United States data 2012). The data also show that emission inventory

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for sub sectors was also one of growing concern especially in the transportation, electricity and industrial sectors with residential and other non-fossil combustions contributing meager or smaller amounts to emissions in general.

Other studies also depict that the ozone layer depletion is also moving faster than normal with EPA 2012 data showing that there are decreases in the global amount of cloud variation below 3.2 kilometers of the earth's atmosphere compared to the anomaly in cosmic ray counts at climax. Carbon dioxide emissions reduction gains also appeared to have been achieved between 2009 till 2017 largely due to the past United States President Obama's environmental friendly policies and their implementation in the United States.

However other studies argue that there exist accumulation in carbon dioxide in other sectors that have not been accounted for making the EPA data reflect a mixed results of emissions increases and decreases IEA 2013 Report.This study investigates the relationship between industrial activities and environmental pollution with special emphasis on emissions which are largely responsible for global warming and ozone layer depletion. The mixed effect estimation technique (Quantile Regression (Qreg)) is utilized in the study. The study investigates if industrialization has specific effects on emissions levels in particular allowing us to draw conclusion and an evidence of a link between the two.

Scope and Objectives of the Study

In this subsection the scope and objective of the study is stated. The broad objective of the study is to study the relationship between industrial activity and environmental pollution across six regions. The specific objectives of the study include to: a.) determine if good environmental policy and planning reduce the negative external consequence that industrial activity can cause to the environment b.)ascertain if the current level of industrial activity is causing environmental degradation and affecting the ecological environment using world regional data

Short Review of Literature and Trend Analysis

In this section a short review of existing literature is conducted. Studies already posit that pollutant concentration are high in many developing countries and they remain a threat to health and shortens lifespan Chen, Ebenstern and Greenstone (2011). There is also a projection that most Green House Gases (GHG) emissions will occur in developing countries e.g. India andChina, Chen et al (2011). Many developing countries also remain at levels where economic growth and development trumps environmental regulation concerns Copland and Taylor (2004), therefore environmental concerns are of a lesser priority in many developing countries Peng and Bao (2006). Industrial restructuring and Science and technology progress can substantially reduce population and improve the environment without affecting economic growth significantly Lopez (1994).

Many studies have also used GDP growth rate as an indicator for industrial output and economic growth in the study of the relationship between environmental and industrial activityXu and Liu (2004). There are also existing arguments that the intensity of development largely affects economic benefits of resource use, efficiency of resource use and environmental regulation Xu and Liu (2004). Zhang (2009), also study the intrinsic connection between economic growth and environmental quality while considering the agglomeration of the economy only.

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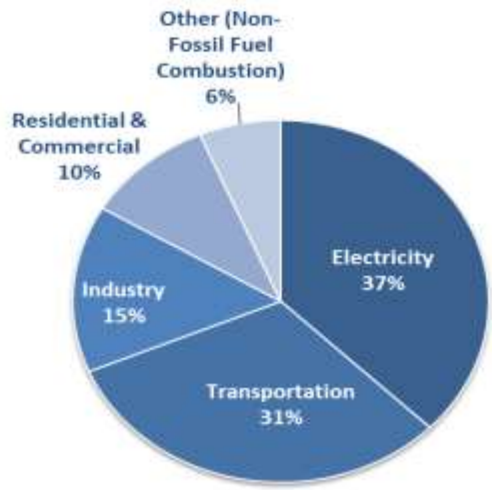
Fig.1 Emissions across Sectors from 1990 to 2015in the United States



Note: The above is obtained from all emissions estimates from the inventory of the United States Greenhouse emissions and sink from 1990 to 2015 See Environmental Protection Agency (EPA) DOI available at http://www3.epa.gov/climatechange/ghgemissions/gases/co2.html

A few have also dealt with the issue of coupling between industrial structure and environmental pollution, stating that two effects of the process include a.) the stress effect of industrial structure on environmental quality b.) the effect of environmental quality on industrial structure, thereby considering the nature of the bi-directional relationship that exist between industrial activity and environmental pollution in generalZhang (2009),. There is statistical evidence that transportation and electricity alone account for about 68% of emissions in the United States alone US EPA 2012 Statistics. Others are accounted for by industrial, residential use of energy and other concerns (see Figure 1), The World is also experiencing low cloud amounts and increases in cosmic ray discharge due to cloud layers thinning out, with significant cosmic ray increases noticeable from 2000 onwards. The implication of these observations depict that it is likely that there exist a relationship between emission increases and temperature variations Worldwide either directly or indirectly (see Figure 2).

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Fig.2 Global Variation in Cloud Amounts and Cosmic Ray Counts At Climax for the United States

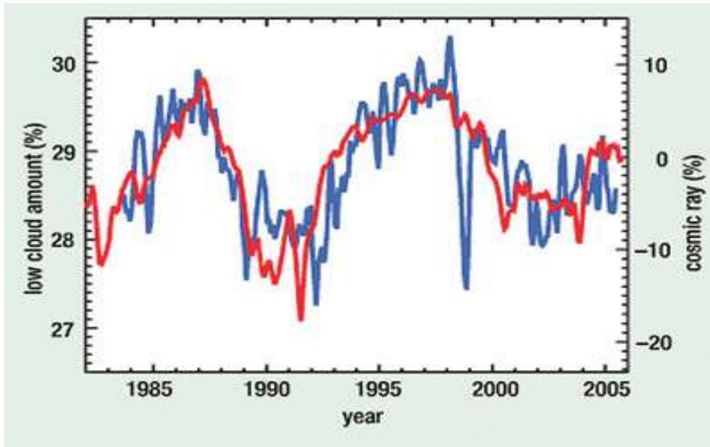
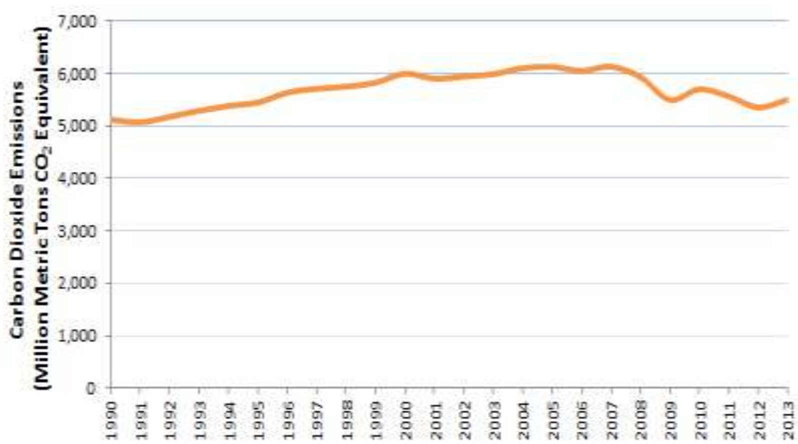


Figure 2. Global variation in cloud amount for clouds below 3.2 kilometers above sea level (blue line) compared to the anomaly in cosmic ray counts at Climax, Colorado (red line).[6]

Note figure 2 above shows global variation in cloud amounts and cosmic ray counts specifically for the US.

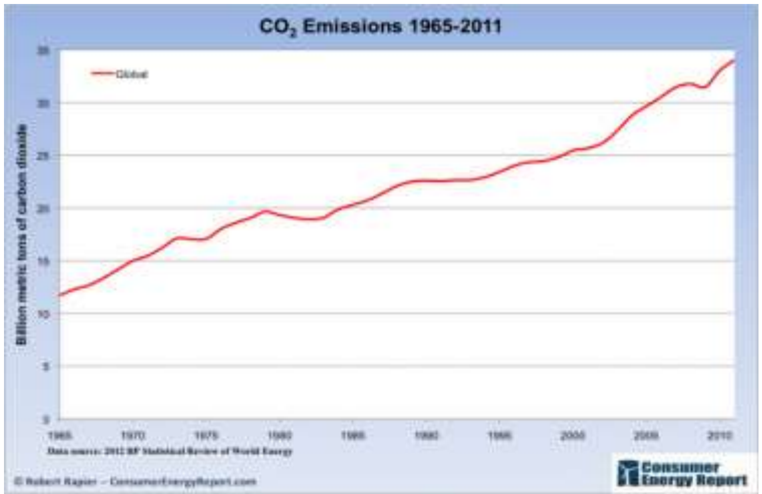
Source: EPA Data United States

Fig. 3 Carbon Dioxide Emissions in Million Metric Tons for the United States



Note: The above is obtained from EPA data of the United States it depicts carbon dioxide emissions in Millions of Metric Tons Available athttp://www3.epa.gov/climatechange/ghgemissions/gases/co2.html

Fig. 4 World Carbon Dioxide Emissions from 1965 to 2011



Note:The graph shows that the growth rate in emissions over the past decade is faster than that of previous decades — indicating carbon dioxide emissions have accelerated in recent years. Prior to 2002, the incremental annual increase had never reached 1 billion new metric tons of carbon dioxide. Since 2002, 1 billion incremental tons have been added three times: In 2003, 2004, and 2010.http://www.energytrendsinsider.com/2012/07/02/global-carbon-dioxide-emissions-facts-and-figures/

Source: The United States Consumer Energy Report.

Trends also showing increases in World carbon dioxide emissions increases is presented in Figure 3. It depicts that carbon dioxide releases into the Worlds atmosphere has accelerated significantly in recent years, causing stakeholder to consider urgent needs to curb emissions using smart technologies and innovation as well as strong regulation laws (US Consumer Energy Report 2013).

Trends in figure 5 also show strong emissions increases for the Asia pacific region, this is attributable to high growth and level of growing industrial capacity in the region particularly from China. This is opposite for the United States and the EU with relative smaller increases and in the European Union in particular where economic growth has been known to peak. Particularly the over 45 % decline in the use of Coal in the United States in the last twenty years has helped curb emissions in general from the United States. Trends in figure 6 show that the emissions from the Middle East exceeds those from Africa and Central and South America for developing countries showing the level of consumption of fossils across regions in general. Other issues of gas flaring and petroleum exploration activities are also responsible for increases and surge in emissions from the Middle East suggestive of intense negative externalities from the industrial and transportation sector.

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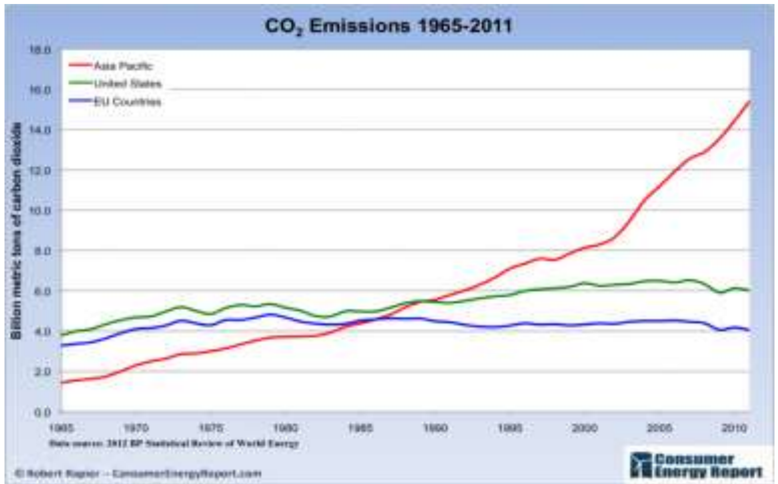
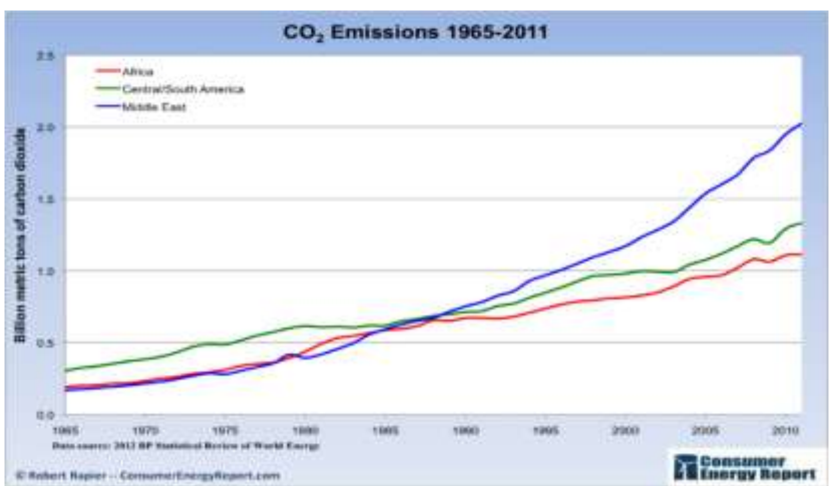
Fig. 5 Carbon Dioxide Emissions for Asia Pacific, the United States and the EU



Note: This figure closely resembles the coal graph from Shockers because in fact global coal consumption is the largest contributor to rising carbon dioxide emissions. Asia Pacific is the source of 45% of global carbon dioxide emissions, and is on a growth trajectory to reach 50% by the end of the decade. In the U.S., coal consumption is on the decline because new supplies of natural gas are displacing coal in power plants. The change has been so dramatic that since 2006, the U.S. is the world leader in reducing carbon dioxide emissions:

Source : The United States Consumer Energy Report.

Fig. 6 Carbon Dioxide Emissions for Africa, Central and South America and the Middle East



Note: The above shows carbon Dioxide emissions for Africa, Central and South America and the Middle East while each region's total is far less than Asia Pacific's 15 billion tons of emissions in 2011, the trends are the same. Developing countries are increasing their emissions as they increase standards of living.

Source : The United States Consumer Energy Report

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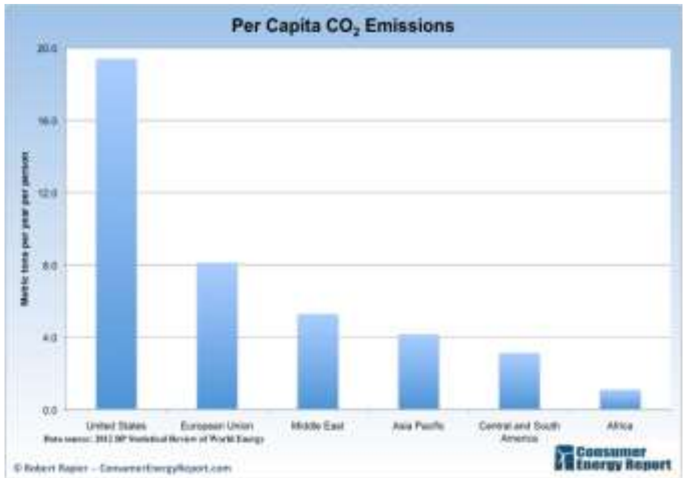
Fig. 7 Regional Per Capita Carbon Dioxide Emissions



Note: The above depicts world per capita emissions in Metric Tons for Regions

Source: The United States Consumer Energy Report

The above levels of emission across regions only account for aggregate emissions from regions. Regional per capital emissions are depicted in figure 7. It shows that the United States alone accounts for about 18 metric tons of carbon dioxide emissions per person, which is twice what is consumed in the European Union and more than thrice consumed in other regions. Africa has the lowest per capita emission consumption due to high level of poverty and poor level of industrialization in general.

EMPIRICAL ANALYSIS

Data

In this sub section the data used in the study is presented. All data is drawn from the data market of Iceland. The study utilizes panel data for six regions, they include sub Saharan Africa, the European Union, South East Asia Pacific, North America (which include the United States, Canada, Mexico and the Caribbean), the Middle East and North Africa and finally Australasia (Which include Australia and New Zealand). Other studies which utilized panel data in the studies of similar nature include Ojeaga and Odejimi (2014) and Ojeaga P. et al (2014) respectively.In studying the relationship between industrial activity and environmental pollution the study first examines the causative effects of temperature changes since it is established thatradioactive forcing from emissions that deplete cloud layers is the major causeof climatic changes. Past studies already state that there exist no direct relationship between climatic change and carbon dioxide emissions, however specific findings exist on the relationship between human activity and emissions in general (IEA Report, 2013). The data used in the study include world annual temperature anomaly in degrees Celsius, emissions in metric tons of carbon dioxide discharges, industrial activity in GDP per capita which measures industrial output in countries across regions

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in United States Dollars (USD), the logarithm of population which captures population in countries across regions, energy use in megawatts using coal energy generation and alternative energy generation for fossils (dirty) and non-fossils (clean) energy generation sources. Two model specifications are estimated they include the first where all variables are included and the dependent variable is Temperature change in degree Celsius and the second where the dependent variable is carbon dioxide emissions which in this case is our measure of environmental pollutions. The fixed effect dummy (year) is included in the study to control for within group effect that are likely to bias regression estimates since it is likely that for instance some years are likely to be hotter than others significantly making us to assume that human activity is largely responsible for climate change due to high variability in temperature in that year.

Theory of Climate Change and Industrial Activity

In this sub section the theory and methodology of the study is explained. The DICE model is an improved version of the Ramsey Model which did not include climate investments, which were found to be as a result of capital investments in the standardized model (i.e. the 2016 model).The DICE 2016 model is based on the social welfare function (SW), which is the discounted sum of population weighted utility of per capital carbon consumption, expressed in equation 1 as previously stated by Nordhaus (2016),

(Eqn. 1) $SW = \sum_{t=1}^{Tmax} N\,[C_t\,, L_t]\,R_t = \sum_{t=1}^{Tmax} U\,[C_t]\,L_t R_t$

$where\ R_t$in this case is the discounted factor, $R_t = (1+\rho)^{-t}$ and ρ is the pure rate of social preference and discount rate of welfare, e_t is the per capital consumption,$and\ L_t$ is population. The utility function if carbon emission is viewed as a consumption bundle is written as

(Eqn. 2) $U_C = C^{1-\alpha}/\ (1-\alpha)$

The parameter α is the generational inequality aversion. The net output of damages and abatement to the environment is now expressed by $Q_{(t)}$ as shown in equation 3

$(Eqn.3)Q_{(t)} = \Omega_t\ \ [1- \ \wedge_t\ ]Y_t$

Given that Y_t is gross output, which is given a Cobb Douglas function of capital, labour and technology. Total output in this case is the ratio of total consumption and total gross investment. The variables Ω_t and $\wedge_t$ are the damage and abatement functions respectively, (see Norhaus D., 2016). The damage function can be given by equation 4 as:

(Eqn. 4) $\Omega_t\ = D_t\ /[1+\ D_t\ ]$

Given that $D_t = \varphi_1\ T_{AT(t\,)} + \varphi_2\ [T_{AT(t\,)}\,]^2$. This describes the economic impact or damages of climatic change. This is in reality a key factor in calculating the SCC where T_{AT} referred to as sufficient statistics for damages is. It should be noted that the damage function was revisited in 2016. Other uncontrolled industrial carbon dioxide emissions are given by a level of carbon intensity $\gamma_{(t\,)}$, times gross output Nordhaus (2016). Total emissions $E_{(t)}$ are equal to uncontrolled emissions reduced by the emissions reduced rate$\mu_{(t\,)}$, plus exogenous land use emissions given as

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$(Eqn.5)$ $E_{(t)} = \gamma_{(t)}\,[1-\mu_{(t)}]Y_t + E_{Land(t)}$.

This can be linked geophysically to greenhouse gas emissions and therefore to carbon cycle, radioactive forcings and climate change expressed below as ,

(Eqn.6) $M_{j(t)} = \emptyset_{oj}E_{(t)} + \sum_{1=1}^{3}\emptyset_{ij}\, M_{i(t-1)}$

It is assumed that there exist three earth geophysical reservoir given as j, where j is = AT (Atmosphere), UP (Upper Oceans and biosphere) and LO (the Lower Oceans). All emissions are assumed to flow into the atmosphere, absorbed partly by the oceans and other ground or surface waters. The relationship between greenhouse gases (GHG) accumulators and increased radioactive forcing is shown below as :

(Eqn. 7) $F_{(t)} = \eta\{log_2\,[M_{AT(t)}/M_{AT(1750)}]\} + F_{EX(t)}$

$F_{(t)}$is the change in total radioactive forcings from CO_2 and other anthropogenic sources. It is essential to state that radioactive forcings are responsible for global warming, therefore we express temperature changes in a specified two level global climate model as

(Eqn.8) $T_{AT(t)} = T_{AT(t-1)} + \varepsilon_1\,\{F_{(t)} - \varepsilon_2\, T_{AT(t-1)} - \varepsilon_3\,[T_{TAT(t-1)} - T_{LO(t-1)}]\}$

(Eqn.9)$T_{LO(t)} = T_{LO(t-1)} + \varepsilon_A\,[T_{TAT(t-1)} - T_{LO(t-1)}]$

Given that$T_{AT(t)}$ is the global mean surface temperature, and$T_{LO(t)}$is the mean temperature of the deep oceans. The stated climate model above have been modified to reflect the Earth Climatic Systems (See Nordhaus D. (2016) for further discussions). The social cost of carbon is therefore expressed based on the aboveas :

(Eqn. 10) $SCC_{(t)} = \frac{\partial sw}{\partial \varepsilon_t} / \frac{\partial SW}{\partial C_t} = \frac{\partial C_t}{\partial \varepsilon_t}$

Therefore the social cost of carbon $SCC_{(t)}$ is a ratio of change in consumption per unit change in emissions over time $(\frac{\partial C_t}{\partial \varepsilon_t})$.The estimation technique used in the study is the quantile regression estimation technique. The standard linear regressions is based on conditional mean function E(y|x), however this provides only a partial relationship, in cases where there is interest in describing relationship at different points in the conditional distribution of y , quantile regression often provides the capability to do so. It is based on estimating relationship between regressors and outcome using the conditional median function instead of the mean Q_q(y|x), where the median in this case is expressed in the 50^{th} percentile.

ISSN 2054-6351 (print), ISSN 2054-636X (online)

The quantile q ∈ (0,1) is that y splits the data into proportions q and 1-q. If therefore f(y_q)=q hence $y_q = f^{-1}$(q) for the median q=0.5. Quantile regression therefore minimizes a sum that obtains the asymmetric penalties (1-q) $|e_i|$ for over-prediction and q $|e_i|$ for under-prediction with its computation often requiring linear programming. It obvious are that it is a.) more robust since it accommodates outliers that the least squares estimation technique b.) it is a semi parametric estimation method hence it is not plagued with parametric distribution errors. The quantile regression estimator for quantile q minimizes the objective function

(Eqn. 13) $Q(B_q)= \sum_{i:y_i \geq x_i' \beta}^{N} q|y_i - x_i' B_q| + \sum_{i:y_i \leq x_i' \beta}^{N} (1-q)|y_i - x_i' B_q|$

The above non-differentiable function is minimized via the simplex method which is guaranteed to yield a situation in a finite steps of interactions. Industrial activities such as gas flaring, vehicle emissions and other industrial discharges contribute significantly to increases in environmental toxins. It is also worthy to mention that such environmental toxins are largely responsible for radioactive forcing which are the main driver of temperature change.Two model specifications are implemented in the study since we first investigate the factors responsible for temperature changes (TC) in general where temperature changes will be a function of emissions (EM), industrial activities (IA), human activity (HA), use of unclean energy sources captured by fossil use and specifically by coal energy generation use (CU), and finally alternative energy use (AU), therefore allowing us to state temperature changes below as

TC f (EM, IA, HA, CU and AU)

While environmental pollution (EP) in this case captured using Carbon dioxide emissions, will be a function of the following factors which include industrial activities (IA), human activity (HA), use of unclean energy sources capture by fossil use specifically coal use (CU), and finally alternative energy use (AU), environmental pollution will be a function

EP f (IA, HA, CU and AU)

The two model specification to be estimated will therefore be expressed in equations 11 and 12 as follows as:

(Eqn. 11) $TC_{i,t} = \alpha_0 + \alpha_1 EM_{i,t} + \alpha_2 IA_{i,t} + \alpha_3 HA_{i,t} + \alpha_4 CU_{i,t} + \alpha_5 AU_{i,t} + \varepsilon_{i,t}$

(Eqn. 12)$EP_{i,t} = \alpha_0 + \alpha_1 IA_{i,t} + \alpha_2 HA_{i,t} + \alpha_3 CU_{i,t} + \alpha_4 AU_{i,t} + \varepsilon_{i,t}$

Where $\varepsilon_{i,t}$ is the error term, $\alpha_{0,}$ the constant term and $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5 \alpha_6$ are the coefficients.Koenker and Basset (1978), and Koenker (2005) state that quantile regression is a useful tool for empirical work. The computation is quite straight forward, on the other hand obtaining the corresponding standard errors is often perceived as problematic. Although there are doubts about its asymptotic validity in case of quantile regression (Machado and Silva, 2013) the pair of bootsrapped estimator enjoys wide usage and the simulation results suggests that it is likely to perform well in general Buchinsky (1995).

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The linear quantile regression is given as

(Eqn. 13) $Y_i = X_i'\beta_{(\tau)} + \mu_{i\,(\tau)}$

Where $Q_{\mu\,(\tau)}$ (T/X_i')=0

The seminar paper by Koenker and Basset 1978 and Koenker (2005), state that parameters of interest can be estimated by

(Eqn. 14) $\hat{\beta}_{(\tau)} = {}^{arg\,min}{}_{b} 1/n \sum_{i=n}^{n} e_\tau\ (\mu_{i\,(\tau)})$

Where $e_\tau(a) = a\ (\tau - 1\ (a < 0))$ is the function and that under the conditions of suitable regularity conditions including the assumptions that the errors are $\mu_{i\,(\tau)}$and iid. The assumptions that the errors are independent and identically distributed (iid) has been typical of the literature on robust regression of the 1970's Hogg (1979). Kim and White (2003) considered the asymptotic distribution of the quantile regression estimator under more general conditions leading to conclusion that where the errors are independent but not identically distributed the quantile regression is possibly misspecified. The Machado – Santos Silva (MSS) test is simple enough to be routinely performed after quantile regression thereby providing information not only about the covariance matrix but also of the relevance of estimating multiple quantiles. The qreg2 is a wrapper for qreg (quantile regression) and reports standard errors at t-statistics that are asymptotically valid under heteroscedasticity and misspecification. In addition qreg2 reports the value of the objective function defined as the average of the check function and the R-Squared defined as the squared of the correlation between fitted values and the dependent variable. Machado and Silva (2013), state that the qreg2 wrapper procedure often follow a small sample simulation with the simulated data generated by

(Eqn. 15) y_i =1+ βx_i +exp (ωx_i) ε_i for i= 1,……..n

Where $x_i \sim x_{i\,(3)}^{\,2}$, $\varepsilon_i \sim$ N (0,1) and $\beta = 1$.

Its suitability (i.e. quantile regression) stems from that fact that it avoids waste of time that are common in time consuming and in large sample analysis.

RESULTS

The fixed effect variable (year) was found to be significant in both regressions allowing us to state that it is our identified variables that are responsible for temperature changes as well as environmental pollutions in the two model specifications, making our regression estimates not to be likely biased. The results of the two model specifications estimated in the study are presented in the study in tables 1 and 2 respectively. The quantile regression wrapper (qregw) handle devised by Machado and Silva (2013) is the preferred and reported results owing to its superior results in column 3 in both tables 1 and 2 respectively for the two model specifications, although the simple quantile regression (qreg) and bootstrapped quantile regression (bsqreg) are presented in Columns 1 and 2. The results for all three columns in the two tables do not differ significantly depicting the

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robustness of the estimated models in the two specifications presented. The first table (i.e. Table 1) depicts the regression with temperature changes as dependent variable. Other explanatory variables used in the study include carbon dioxide emissions, industrial activity (measured using GDP per capita in US Dollars), Human activity captured using the population (which is logged to reduce the noisiness of the population variable), and country specific use of energy which reflects energy policy captured using coal energy use and alternative energy use respectively and hence the damage and abatement controls.

Table 1: Regressions of Emissions on Temperature Changes

VARIABLES	(1) Qreg Temperature changes	(2) Bsqreg Temperature changes	(3) Qregw Temperature changes
Emissions	-0.0735***	-0.00624	-0.164*
	(0.00840)	(0.0130)	(0.0887)
Industrial Activity (GDP)	0.0789***	0.0693***	0.117***
	(0.00730)	(0.00738)	(0.0360)
Human Activity (Population)	0.0795***	0.177***	0.401***
	(0.00817)	(0.0299)	(0.132)
Coal Energy Use	0.00138	0.0137*	-0.0117
	(0.00238)	(0.00734)	(0.0149)
Alternative Energy Use	0.0184***	0.0608***	0.0227
	(0.00420)	(0.00779)	(0.0218)
Fixed Effects (Year)	-0.174***		
	(0.0324)		
		(0.00241)	(0.00623)
Fixed Effects (Year)		0.143***	0.142***
		(0.00210)	(0.00412)
Constant	-0.788***	-4.158***	-6.025***
	(0.137)	(0.520)	(1.423)
Observations	267	261	264
Number of id	6	6	6

Note: All Standard errors are in parentheses and *** p<0.01, ** p<0.05, * p<0.1represents 1%,5% and 10% significant levels respectively.

The results in table 1show that emissions does have a weak negative effect on temperature changes and therefore have a positive effect on climatic changes in general, reducing temperature changes by 16.4 percentage points therefore there exist no strong direct link between emission increases and temperature increases . The strongest contributor to increases in temperature was human

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activity which was found to contribute significantly in a positive manner of up to 40.1 percentage points to temperature increases and therefore has a negative significant effect on climate change. Industrial activity also have a positive and significant effect on temperature increases and therefore affect climatic changes negatively contributing up to 11.7 percentage points to adverse climate changes. The variables coal energy which captures the use of fossils as well as alternative energy sources have no significant effect on temperature increases.

Table 2: Regression of Industrial Activity on Environmental Pollution.

VARIABLES	(1) Qreg Emissions	(2) Bsqreg Emissions	(3) Qregw Emissions
Industrial Activity	0.737***	0.737***	0.839***
	(0.0307)	(0.0424)	(0.0353)
Human Activity	0.725***	0.725***	0.862***
	(0.0567)	(0.0550)	(0.0434)
Coal (Fossils) Energy Use	0.116***	0.116***	0.0920***
	(0.0124)	(0.0183)	(0.0136)
Alternative Energy Use	-0.194***	-0.194***	-0.218***
	(0.0462)	(0.0312)	(0.0397)
Fixed Effect (Year)	-0.0350***	-0.0350***	-0.0377***
	(0.00219)	(0.00220)	(0.00153)
Constant	60.95***	60.95***	63.24***
	(4.286)	(3.904)	(2.942)
Observations	279	279	279
R-squared		0.892	0.886

Note: All Standard errors are in parentheses and *** p<0.01, ** p<0.05, * p<0.1 represents 1%,5% and 10% significant levels respectively.

The results in Table 2 show the regression of industrial activity on environmental pollution. The results show that industrial and human activities were contributing significantly to carbon dioxide emissions making industrial and human activities to be the most causative sources of environmental pollution. It was also found that the use of fossils were also increasing pollution significantly. However the use of renewable energy sources were found to reduce environmental pollution showing that renewable and innovative energy sources were probably a deterrent to bad practices in the utilization of the earth's resources (see Table 2 Column 3)

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DISCUSSION

In this section the results of the study is discussed.The study investigates the relationship between industrial activity and environmental pollution for six regions which include Australasia, the European Union, North America, the Middle East and North Africa, South East Asia (including China) and finally Sub Saharan Africa. The specific objectives of the study included to a.) determine if good environmental policy and planning reduce the negative external consequence that industrial activity can cause to the environment b.) ascertain if the current level of industrial activity is causing environmental degradation and affecting the ecological environment using regional data. It was found that good energy policies were likely to act as deterrent to environmental pollution with the use of alternative energy sources having a negative and significant effect on emissions of carbon dioxide and suggestively reducing greenhouse gases (GHG). It was also found that the current level of industrial activity was also promoting pollution across regions with suggestive stronger implications for South East Asia and the Middle East on an aggregate level and the United States specifically on considering per capita pollution. This shows strong consequences of industrial activityin increasing radioactive forcing (and then environmental pollution) as well as the good policy implicative results of energy sources on environmental pollution particularly strategic investment in renewable energy sources.

CONCLUSION

In this section the study is concluded. The study investigated the relationship between industrial activity and environmental pollution. The study tried to establish if there exist a direct link between emissions and temperature changes, Consistent with IEA 2013 Report, It was found that emissions have no strong significant effect on temperature changes in regions depicting no strong direct link. It was however found that industrial and human activity causes increases in temperature anomalies in general. It was found that human activity was a major source of environmental pollution with human and industrial activity all significantly increasing environmental pollution. The choice of energy mix, by implication country specific energy policy was found to have a significant effect on emissions increases and on environmental pollution with alternative energy sources having reducing and significant effects on environment pollution. The implications of these findings are that,directed policies can help reduce environmental pollution specifically strong investment in renewable energy sources .Regulation measures entrepreneurial activities in the industrial sector towards driving green productive practices can also help reduce the impact of industrial activities on environmental pollution in general if environmental best practices are implemented .

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