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DSCI 5340 Project Report

**Global Carbon Iv Oxide Emission To The Environment**

**Abstract**

* The purpose of this study was to model the predictive model of global Co2 to provide a guideline for policy formulation.
* This study sought to establish the effect of global Co2 on both animals and plants.
* The study focused on 10 years from 2010 to 2019.
* These analyses used secondary data from World Bank.
* Researcher used Stata software version to analyses the collected data.
* Statistical analysis revealed that there is linear relationship between time and Co2 emissions.
* The main policy recommendation for the policy makers is to come up with policies which will ensure minimum Co2 emissions.

**Background Information**

The air consists of several gases, namely carbon iv oxide, oxygen, nitrogen, and many more, each of these gases gets released into the environment at different proportions. Among the released gases, carbon iv oxide is ova very great concern, its release to the environment has affected the environment badly. Emission of carbon iv oxide results from several sources; including fossils, emissions from plants. Combustion of fossil fuels is another form through which carbon iv oxide can be released into the environment. The roads are full of vehicles every day, these vehicles burn fuel to move; as the fuel burns, the hydrocarbons are converted into CO2 + water, the CO2 released is spread across as the vehicle moves. Another locomotive that spreads the carbon IV oxide to the environment is the trains which burn the fuel in the same manner. Air transport is another spread method; the fuel hydralazine is burned into the environment to release CO2 +water.

**Problem Statement**

* Researchers argue that some of these effects are long-term, while some are short-term.
* The release is directly related to the depletion of the ozone layer since the gas reacts to the ozone, leading to the blanket layer splitting that would otherwise protect the sun layers from being released.

**Effects of Carbon IV Oxide**

Once the sun rays have been released into the environment, it results in global warming where there is the constant increase of ocean tides, increasing adverse temperatures across the tropics. This condition eventually leads to change in weather and nearly all the world's climatic conditions. The release of carbon iv oxide into the environment has made the world fight a global increase in adverse climatic change. The climatic change results in an increase in floods and droughts. Flooded places become more flooded while the dry places become drier. This has led to food security problems across the world because adverse climatic conditions affect the growth of crops. Most of them wilt or wither before they mature and hence leading to the death of very valuable crops to the humans. Carbon iv oxide emission has affected the climatic condition and has been very dangerous to the health of animals. Once the chemicals are released, they lead to the contraction of several diseases to the users. Some of these diseases include pulmonary diseases such as bronchitis, lung cancer, and event stomach. The result of these indications is that people begin to have deteriorated health conditions, thus leading to death and reduction of populations of the people. In plants, the carbon iv oxide emission leads to the formation of the blue haze, this bluish color that is seen amid the forested areas, more so in the morning or evenings: The haze results from the reaction of carbon with the atmospheric oxygen leading to the formation of the CO2.

**Quantitative Analysis**

* The researchers can employ qualitative analysis to analyze the emission of carbon dioxide emissions into the environment This could be results analyzed statistically from the environmental scientists.
* It enables people to learn more about the scientific analysis of carbon dioxide emission effects on the environment.
* This research is solely purposed to dwell around the carbon iv oxide to the environment.
* It will chemically analyze the release of CO2 into the environment and then analyses the effects of these chemicals on the environment.
* Eventually, the paper will explain how to control the release of this gas into the environment to control these effects.

**Objectives**

* The main objective of this study was to come up with a predictive model of the global CO2 emissions.

**Specific objectives**

* To demonstrate the cycle of carbon IV oxide to the environment.
* To demonstrate the effects that emission of carbon iv oxide to the environment has on animals and plants.
* To formulate policies based on the global CO2 predictive model
* To establish CO2 trend over time

**Hypothesis**

* Time influences the amount of carbon ii oxide emitted to the environment.

**Justification**

* The increasing levels of global CO2 together with structural and policy changes are the primary motivation behind this analysis.
* This research provides current empirical analysis with recent data and employed descriptive analysis and more advanced econometric of CO2 as it relates to climate change over years.

**Literature Review**

Carbon iv oxide is one of the gasses that are emitted in the environment, the emission of carbon iv oxide can happen either through natural or artificial sources such as sulfur dioxide, methane, hydrogen sulfide, volcanic eruption, or waste products from plants and animals (*Carbon Cycle and the Earth’s Climate*, 2019). The emission of carbon iv oxide into the environment follows a cycle that explains the emitted gasses' chemical processes once it gets released into the environment. One of the strategies used to prevent the penetration of carbon iv oxide into the atmosphere through this target is not maximally achieved. Carbon iv oxide takes nearly 100 million years through chemical reactions and tectonic activity to move through the rocks, soil, atmosphere, and the ocean. This forms the onset of the carbon iv oxide cycle that eventually leads to carbon dioxide emission to the environment. The carbon cycle can be scientifically described as the biochemical cycle that entails releasing carbon into the biosphere, pedosphere, hydrosphere, and atmosphere (*Carbon Dioxide Emission - an overview | Science Direct Topics*, n.d.).

The carbon produced from the living organisms is dispersed in water and reacts to form weak carbonic acid (H2CO3). The weak carbonic acid subsequently losses hydrogen and eventually forms H+, CO32- and HCO3+. Carbonates react with the mollusk shells or the calcium elements, eventually leading to the formation of CO2v, which is released through geologic outgassing (*Carbon Cycle and the Earth’s Climate*, 2019). Carbon iv oxide can also be emitted through photosynthesis, where the plants use the gas to make food during the night. The animals also release carbon iv oxide through respiration, the process by which they make energy. This involves the breakdown of glucose to release adenosine triphosphate + carbon iv oxide + ethanol. Dead plants and animals undergo decomposition in the presence of bacteria, which eventually leads to the release of Co2 from the environment.

The diagram below tries to explain some of how the CO2 cycle always follows.

Diagram

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*Diagram obtained from (“Carbon cycle | ecology,” 2019).*

The cycle of CO2 has several effects on the environment; the most outstanding effect is the greenhouse effect. The electromagnetic spectrum makes the amount of carbon iv oxide that passes through the earth from the atmosphere. Carbon iv oxide absorbs the infrared radiations, confirming the amount of co2 in the atmosphere (Eloka-Eboka, & Inambao, 2019). The Co2 that absorbs infrared wavelength possesses some heat energy which eventually holds a form of heat to the environment. The heat results in an increase in the amount of heat in the tropics and thus results in global warming. A lot of people have complained about the effect of carbon iv oxide on the environment. This concern has spread to nearly all the countries in the whole world.

Most research articles propose that European countries such as the United Kingdom, Spain, and Belgium, together with China, Russia, the United States, and India, are the leading emitters globally. This is because they are more industrialized compared to other countries across the world. The result of this emission is subjected by research to be causing the health complications such as cancer and bronchitis (Eloka-Eboka, & Inambao, 2019). This is mostly caused by CO2 pneumoperitoneum, which influences tumor metastasis. This is confirmed through CO2 insufflation, which leads to the growth of the tumor cells. Once the tumors have grown, they metastasize and eventually spread to many parts of the body.

In the pulmonary system, the CO2 also leads to the development of the inflammation of the bronchus, which leads to pulmonary complications (“Novel Tin (IV) Oxide-Carbon Composite Anode Material for High-Capacity Li-ion Batteries,” 2019). Qualitative research conducted among the members of the public through the interviews and experimentation found that the emission of carbon iv oxide had a lot of effects on the health of the living organisms.

This chapter will focus on specifying the model and research methodology used to show global CO2 trends.

**Research Design**

* This study aims to establish the trend of global CO2 over time.
* This study will use data for the period between 2010-2019 for global CO2.
* The data will be analyzed using MA, AR, ARMA and ARIMA models which are time series properties.
* SAS software will be used for the purposes of statistical analyses.

**Data Collection Technique**

* This study adopted the use of secondary data as an approach to establish global CO2 trend for the period 2010 to 2019.
* Global CO2 data was accessed from world bank website.

**Model Specification**

* A linear regression model was applied to establish the global CO2 trend through use of SAS.
* The regression model below was used in determining the relationship between; time and global CO2
* Yi =β0+βx1+εt

Where;

* Yi₌ Dependent variable (CO2)
* β0 ₌ The constant
* εt₌ Error term
* β1₌ Change included in Y by each x
* T1₌ Time t

**Working Hypothesis**

* H0: Global CO2 levels does not increases over time t
* H1: Global CO2 levels increase over time t
* Regression analysis
* This model focused on establishing possibility of predicting future relationship between time and levels of global CO2.
* To predict future levels of global CO2 linear regression model was developed.
* Through linear regression, a function between the levels of global CO2 and time was developed to predict the future relationship between the CO2 and time.
* Regression analysis used univariate regression model.
* The general form of the equation used is;
* Yi = β0+β1t1+εt
* After analysis, the values of α and β made it easy to predict future values of global CO2 at different time.
* F-ratio will be used to test the goodness of the fit at 5% level of significance.
* Any results above 5% will imply that variables are not significant while any results below 5% will imply that variables are significant. Alpha(α) of 0.05.

**References**

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**ANALYSIS REPORT BEGINS HERE**

Chart, line chart, histogram

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This represents the plot of our data. As shown, it has a upward linear trend to its shape and we will be doing a time series regression analysis on this data.

Graphical user interface, application, Word

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We see P value of less than alpha, R- squared of 83.45

Parameter estimate β0=0.01082+εt=yt. If less than alpha (0.0001) we reject null Hypothesis

The summary shows a linear regression of CO2 emissions vs time. The p-value(<0.05) suggests that the model is significant. The model also defines 83.46% of the variability in data(R-square=0.8346).

Now we run the same data set regression model with missing values of predicting observations 116-120 giving us the intercept.

Graphical user interface, application, Word

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With Durbin-Watson D closer to 0 but greater than alpha we can say there is no evidence of positive auto correlation

The equation for our regression model will be: Yi =β0+βx1+εt

Chart, line chart

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Chart, line chart

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**USING ADDITIVE MODEL FOR TREND**

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Results from SAS after using the additive method to see moving averages across observations and different lags for our data. This is an additional step to build the data up for modelling to see the best fit

Decomposition of the data also we can see trend and forecast of CO2 emissions for the next 12 months for the data after the process.

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**Below we start by running our data to get a time series model.**

A picture containing text, antenna

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Our first differencing for our real time series shows to be stationary. This is code run without any differencing. CO2(stationary) but check with proc ARIMA also.

Graphical user interface, chart, histogram

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The above graph shows the number of lags

Autocorrelation values (AC)

Partial autocorrelation values (PACF)

There are sketches of autocorrelation function and partial autocorrelation function.

From the sketch, the autocorrelation decays as we move down.

The partial autocorrelation sketch is up to the third lag. This indicates that this model will use autoregressive model of order (1,3).

SAC(sample auto correlation)

SPAC(Sample Partial Auto correlation)

SAC dies down very slowly—Time series is non- stationary (for our first one y(CO2) real time series.

In SPAC it dies down quickly after lag one.

**Make it stationary by first differencing**

Graphical user interface, application

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-SAC dies down quickly for different lags- this is now stationary

If correlation function is in lower confidence limit/close to zero

No spike after lag zero it straight cuts off at lag 1

**TESTING STATIONARITY WITH ADF TEST AFTER DIFFERENCING**

Can also implement the ADF test to check stationarity of the time series.

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With all the p values(0.0010) less than alpha we know it is stationary now.

**For Spac, it dies down after lag 3 so we try moving average with order 1(CO2(1))**

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MA(1) zt= at-θ1(at-1)

P value of 0.0013 is less than alpha(.05) which means it significant. Significant if less than alpha, without delta looking at AIC, SBC and Error estimates.

Standard error of 0.112354

AIC -173.918

Looking at Moving average with delta constant and theta 1.Table

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Model without constant is better as MU has a non-significant t value and will not be needed for the series if this model was chosen. As we compare, P value here is 0.8674 which is greater than alpha and therefore not significant. Since in our model, SAC dies down after immediately after lag 0 and SPAC also dies down with only one spike at lag 3, MA (1)with and without constant is just one model built but we can compare to better models AR, ARMA and ARIMA. We will compare other models.

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In this MA model we look at the L-Jungs test of Pvalues to check for adequacy of the model. With the Pvalues all being less than alpha(α). This model will be inadequate.

**ESTIMATING USING ARIMA (1,1) AR(1) model**

Below we compare our time series to model AR(1). For comparison purposes. P=1

We use AR(4) as in or CO2(1) SAC dies down immediately and we see a small spike in SPAC at lag 3. Thus AR(P)….. Zt=δ+φ1(zt-1)+2(zt-2)….+φp(zt-p)+at

AR(1)=Zt= δ+φ(zt-1)+at

Table

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MU which is the mean term constant value of 0.0013709 and the t value of 0.15 adds little to the model. AR 1,1 the coefficient of the lagged value is -0.16426. Standard Error of 0.113807. AIC of -169.97. We see no strong correlation between independent variables. Using the L-Jungs test for this model, P values all less than alpha makes this model inadequate and not fit for this series.

**USING AUTO REGRESSIVE MOVING AVERAGE (ARMA) MODEL (2,3)**

Looking at another ARMA Model (2,3)-Lag 1,2,5 and lag 1,6 for p and q

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Looking at the results for this model. ARMA this is better than the MA model but not AR model looking at AIC, standard of error, however, it does not pass the adequacy test according to J-Lungs test as Pvalue at lag 6 is 0.0073 which is less than alpha (0.05). Therefore, this AR model is still inadequate since less than alpha.

**Estimating an MA(3) model lag 1-2-3**

ARMA considers the change in CO2 as an average vs the AR model

Q=3

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The moving-averageMA1,1 and MA1,2 parameters 1,2 have significant t values. the variance estimate, AIC, and SBC are all smaller than they were for the AR(1) model of -181.6 and -167.008 and a smaller standard of error of 0.1068, indicating that the ARMA(1,1) model fits the data better without over-parameterizing. Also when we use the L-Jungs check for accuracy, we see the pvalues at lag 6 is 0.496 thus, higher than α(alpha) of 0.05. Checking multicollinearity in this model we do not see any strong relationship between independent variables of .90+.

**WHITE NOISE AND RESIDUAL PLOTS**

Looking below, the residual correlation and white noise test plots show that you cannot reject the hypothesis that the residuals are uncorrelated. The normality plots also show no departure from normality. Thus, you conclude that the ARMA(1,1) model is adequate for the change in CO2 emissions series, and **this is the best model for our data set.**

Graphical user interface

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**Graphical user interface, text, application

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We see the best equation for the model: CO2=1 - 0.3076 B\*\*(1) - 0.14583 B\*\*(2) - 0.28798 B\*\*(3)

Where B= (yt-1)

**ANALYSIS OF RESULTS**

* H0: CO2=0
* H1: CO2 is not equal to zero
* The moving average has a p-value of <0.0001 which is less than 0.05 level of significance, therefore moving average term is statistically significant and should be used in the model.
* H0: Time=0
* H1: Time is not equal to zero
* Time has a p-value of <0.0001 which is less than 0.05 level of significance, therefore we reject null hypothesis and use alternative hypothesis. Time is statistically significant in predicting CO2
* R-squared indicates that 37% of the errors in the model.
* The predictive model for CO2 therefore becomes
* Yi = β0+β1t1+εt
* Co2 = 1 - 0.3076 B\*\*(1) - 0.14583 B\*\*(2) - 0.28798 B\*\*(3)

**SUMMARY AND RECOMMENDATIONS**

* The purpose of this study was to create the predictive model of global Co2 to provide a guideline for policy formulation.
* Statistical analysis revealed that there is linear relationship between time and Co2 emissions.
* The best predictive model; Co2 = 1 - 0.3076 B\*\*(1) - 0.14583 B\*\*(2) - 0.28798 B\*\*(3)
* The main policy recommendation for the policy makers is to come up with policies which will ensure minimum Co2 emissions.