

Analysis of Factors Contributing to Climate Change (Based on World Bank Data)

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April 2023

Data Source

Here are relevant links to the dataset used to prepare this report:

- Source of Dataset: <https://data.worldbank.org/topic/climate-change>
- Link to the Excel file used for python program (contained in Google drive folder): https://docs.google.com/spreadsheets/d/12o_9lky8qcKQcj3N1hXS4yZQkAAWzNtz/edit?usp=share_link&ouid=108442379088013897771&rtpof=true&sd=true

Python Program (Code)

The python code used to prepare the graphs in this report is contained in a GitHub repository accessible via the following link: <https://github.com/maeintech/ADS1---Assignment-2>

Abstract

Climate change refers to significant and long-term changes in temperatures and weather patterns brought on by an increase in industrial, commercial, and economic activity. Some effects of climate change include changes in rainfall patterns, rising temperatures, sea levels, and other natural phenomena that many experts have predicted could have an impact on human life. Thus, it has been the center of focus in many discussions among World Leaders in order to mitigate the threats it poses to humanity and livelihood. This report will focus on some of the interrelationships between leading causes of climate change such as generating electricity and heat through different sources, CO2 emissions and Population. For this analysis, the data selected is aggregated by income classes for countries around the world to make it easier to analyze and understand the overall trends.

The analysis showed that China happens to be one of the largest contributors to climate change due to its high CO2 emissions which can be linked to generation of electricity. The data also showed that the type of fuel used to generate electricity plays an important role in the contribution to CO2 emissions and climate change on a larger level.

This analysis is aimed at taking an explorative approach to identify possible relationships or dependencies among factors causing climate change in Country Income Groups across the world. The factors considered in this analysis include CO2 emissions, Gross National Income per capita, Population, Percentage of population with access to electricity and Electricity production from various sources.

One of the leading causes of climate change is known to be the emission of greenhouse gases with CO2 having the highest cause for concern on a global scale.

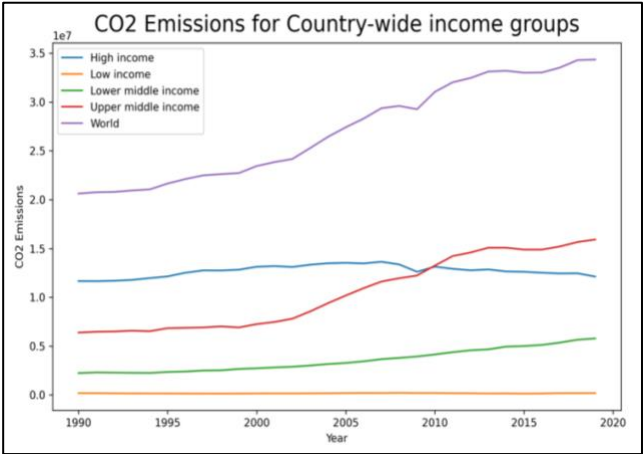


Figure 1

The line plot in Figure 1 above shows CO2 emissions for different country income groups from 1990 to 2020. It can be deduced from the graph that Middle-Income countries have experienced an increase in CO2 emissions with global CO2 emission on an upward trajectory. Upper-middle-income countries can be seen to have the highest degree of increase in CO2 emissions among the country groups. This income group also managed to become the highest producers of CO2 emissions while high income countries can be said to have made efforts to reduce CO2 emissions.

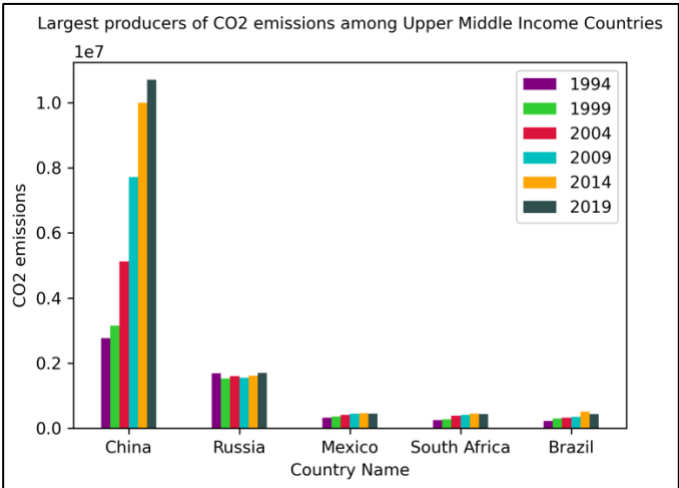


Figure 2

The bar graph in figure 2 above goes on to show the 5 highest producers of CO2 emissions among upper-middle-income countries for 5-year intervals from 1994 till 2019. It shows that China produces significantly much higher CO2 emissions within the upper-middle-income group and might be an outlier

within the group due to its high rate of production and its status as one of the world’s largest economies.

	1994	1999	2004	2009	2014	2019
Country Name						
Russian Federation	2650.0	1750.0	3410.0	9230.0	14630.0	11280.0
China	470.0	860.0	1510.0	3680.0	7470.0	10310.0
Mexico	5420.0	5580.0	7860.0	8940.0	10640.0	9660.0
Brazil	2590.0	4190.0	3340.0	8300.0	12080.0	9220.0
South Africa	3610.0	3330.0	4070.0	6420.0	7340.0	6730.0

Table 1: GNI per capita for Upper Middle-Income countries

Table 1 above helps us to understand how China fits into the upper-middle-income country group on the basis of its relatively low Gross National Income(GNI) per capita. This owed to that fact that China has a very large population despite its high GNI.

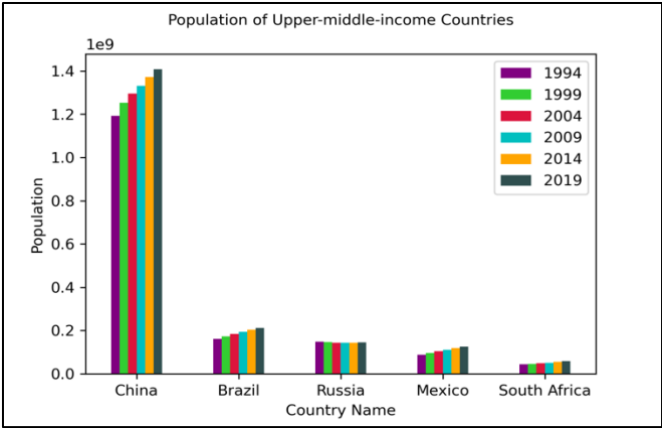


Figure 3

Just like its CO2 emissions, China’s population has grown progressively since 1994 with an 18% increase over 25 years. Despite its efforts to reduce its population, it still experiences progressive growth which translates to increase in production and urbanization among other factors. This subsequently leads to an increase in the emission of CO2 which skyrockets the average figures for the upper-middle-income country group. From the graph, we also notice fluctuations in the population size and CO2 emissions in countries like Russia and South Africa which leads us to investigate other factors at play when it comes to CO2 emissions.

The heat map in Figure 4 shows correlations between several other country indicators including CO2 emissions. From the graph, it is clear that increase in urban population has a huge effect on CO2 emissions. This can be attributed to deforestation activities and air pollution within urban areas. The strong correlation between Forest Area and CO2 emissions

further emphasizes that growth of natural vegetation reduces the effects of climate change.

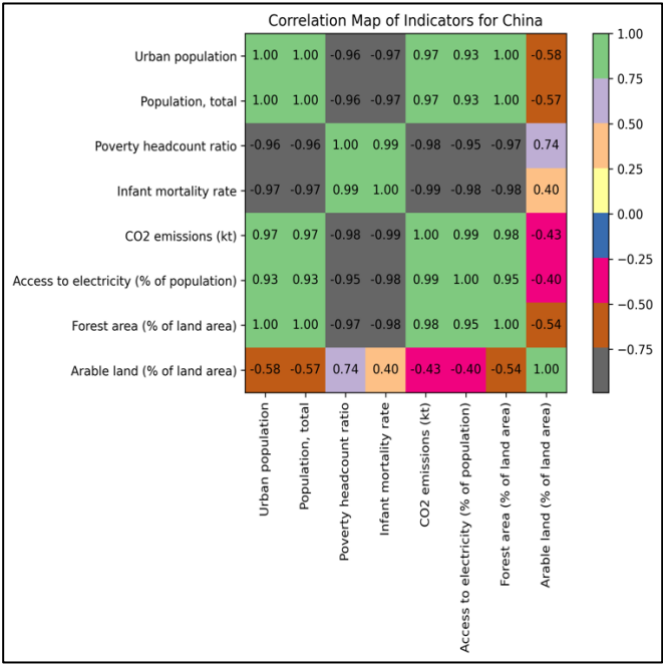


Figure 4

Another important indicator to consider is the percentage of the population with access to electricity. This implies that the more people with access to electricity, the higher the need to produce more electricity within the country. Production of electricity typically involves generating heat from a fuel source.

Figure 5 below shows the percentage of total contribution to energy production from various sources. It is evident that China relies heavily on the use of Coal to produce electricity. The downside for the climate is that combustion of coal for this purpose produces a lot of greenhouse gases.

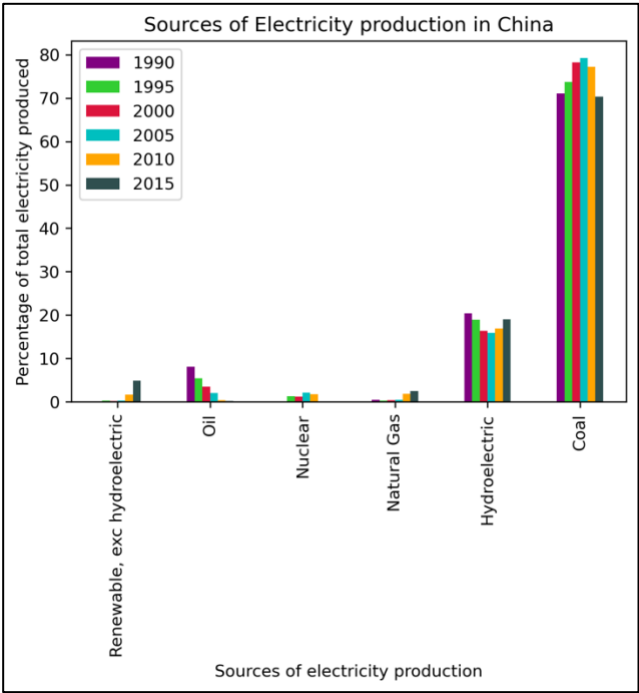


Figure 5

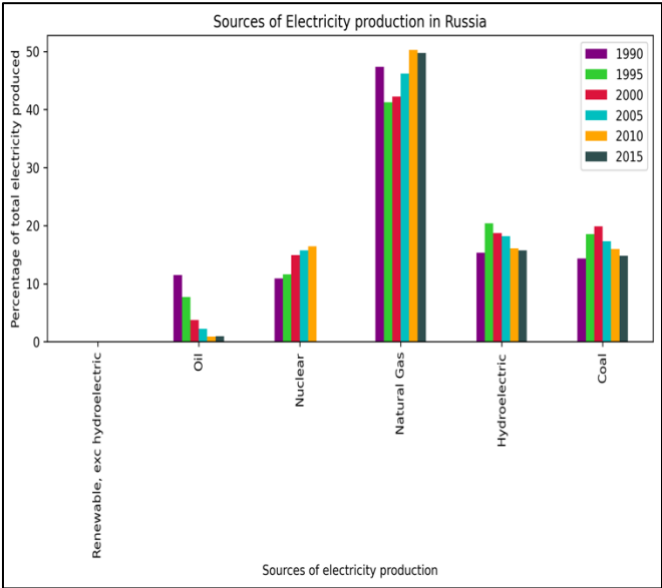


Figure 6

Figure 6 above provides a view of the use of fuels for producing electricity in Russia and not only reminds us that different countries utilize different means of electricity generation, but it also shows that use of natural gas for producing electricity results in reduced CO2 emissions.

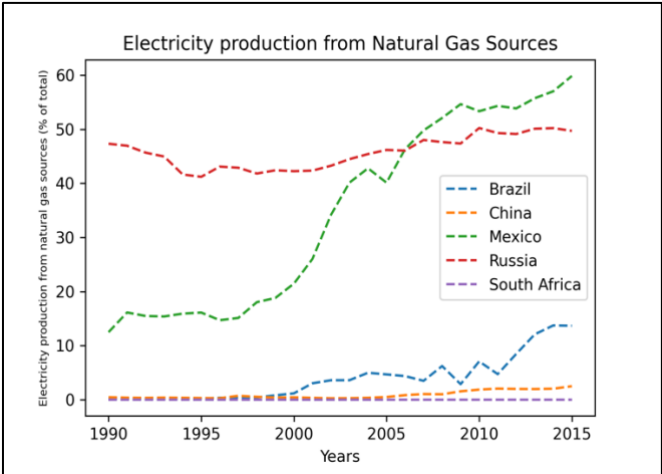


Figure 7

Figure 7 is a visual representation of electricity production from natural gas sources over time for different countries within our scope. When compared against the CO2 emissions for each of these countries, it can be seen that Russia and Mexico produce lower CO2 emissions than China due to their heavier reliance on natural gas sources for electricity production. The low values for Brazil and South Africa can be linked to the fact that these countries do not produce that much electricity by themselves or that they rely on other sources of fuel to generate electricity.