A Descriptive Analysis
of
Climate Change Accountability

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Debate on

Should wealthy nations should take monetary responsibility for poorer nations' growing number of natural disasters?

The United Nationals global warming conference in Glasgow this fall was on headlines across all major newspapers. With scientists warning that every fraction of a degree of warming will lead to more intense heat waves, drought, floods, and wildfires and a 100,000-people rally on Global Day for Climate Justice, the world has come to recognize the severity and urgency of climate change. One of the largest debates during the summit is whether the world's wealthiest nations are disproportionately responsible for global warming, and whether they should compensate poorer nations for increasingly severe weather.

Research Question

How does severe weather experience compare between high- and low- polluters in the world?

    a.   Are there more severe weather events over time?

    b.   Are rich countries polluting more than poorer countries?

    c.   Should rich nations compensate poorer nations for severe climate change?

The NY Times has published an analysis on who has the most historical responsibility for climate change based on CO2 emissions. To further explore the UN climate change debate topic, our project is extending New York Times' analysis on current emissions by analyzing natural disasters as an indicator of heavy polluters affecting neighboring countries . Our main research question is:
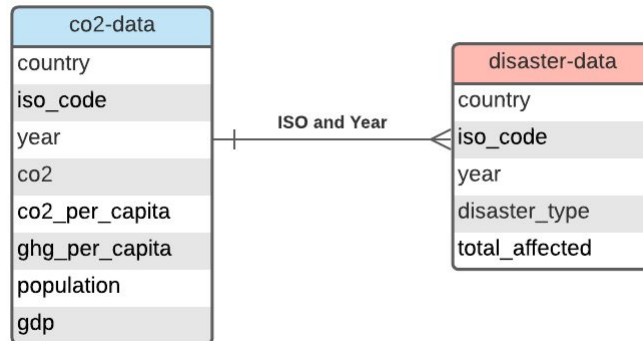
How does severe weather experience compare between high- and low- polluters in the world?

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We will first go over the dataset and assumptions for the project. Next, we will showcase a few important graphs in our analysis. Finally, we will discuss our research question and make recommendations on future steps.

Datasets

Emissions: Our World in Data   Disasters: CRED Database

co2-data
- country
- iso_code
- year
- co2
- co2_per_capita
- ghg_per_capita
- population
- gdp

ISO and Year

disaster-data
- country
- iso_code
- year
- disaster_type
- total_affected

To support our analysis we looked for high quality sources of quantitative data

Our World in Data
    Includes data on Country, year, CO2 emissions, GDP, population
    Date range from 1900-2020
    Key = Country / year

    Also includes regional and world aggregated data. We will primarily work at the country level.
Disasters
    Emdat database
    Center for Research on the Epidemiology of Disasters - CRED. This is a public database that records disaster events around the world United Nations committees, National Governments, US Governments.
 The date range of the dataset goes from 1956 to 2020
    Key = disaster/country/year

Aggregated to the year to merge with co2 data set

Assumptions

- Pollution = CO2 and GHG Emissions

- Wealth = GDP (metric for economic health)

- Severe weather = Subset of Natural Disasters

- Consistent collection metrics and policies

GDP - isn't necessarily an indicator of wealthy countries but it will show that they are producing and is a common metric for economic health
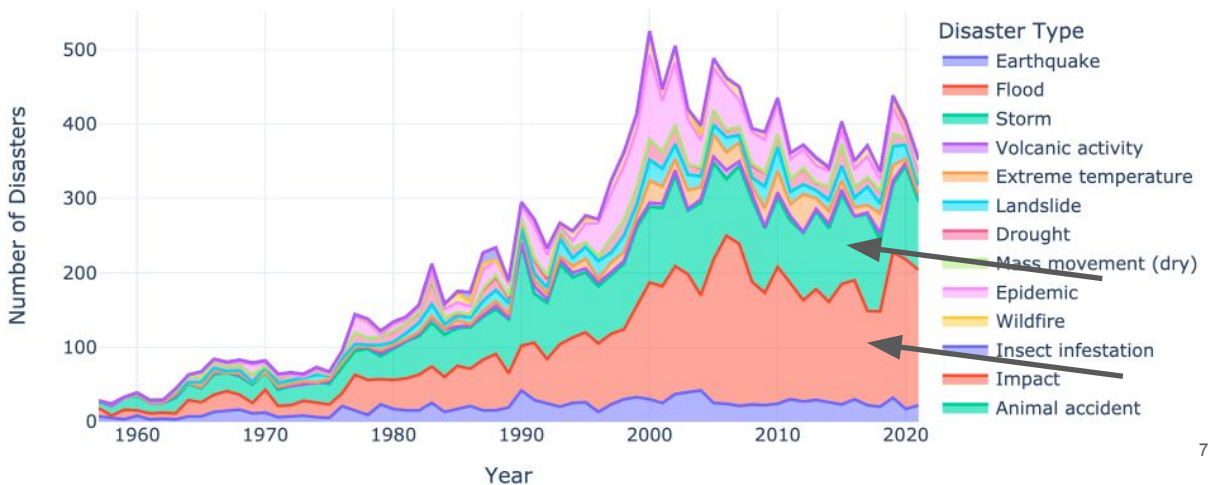
Servere weather == natural disaster (flood, drought, storms)

Disaster and emission data have been consistent since 1956

Analysis

# Are there more severe weather events over time?

Floods and storms continue to push the number of annual disasters.

Looking at trends from 1956 to 2020 we can see there is a trend of increasing storms, floods, and other natural disasters. Extreme weather events, the most common type of natural disasters, are widely considered to be increasing as a result of climate change (Ornes, 2018). We will further explore this rise in relation to rising emissions, who's being affected, and who may be to blame.

Where in the world are the events happening?
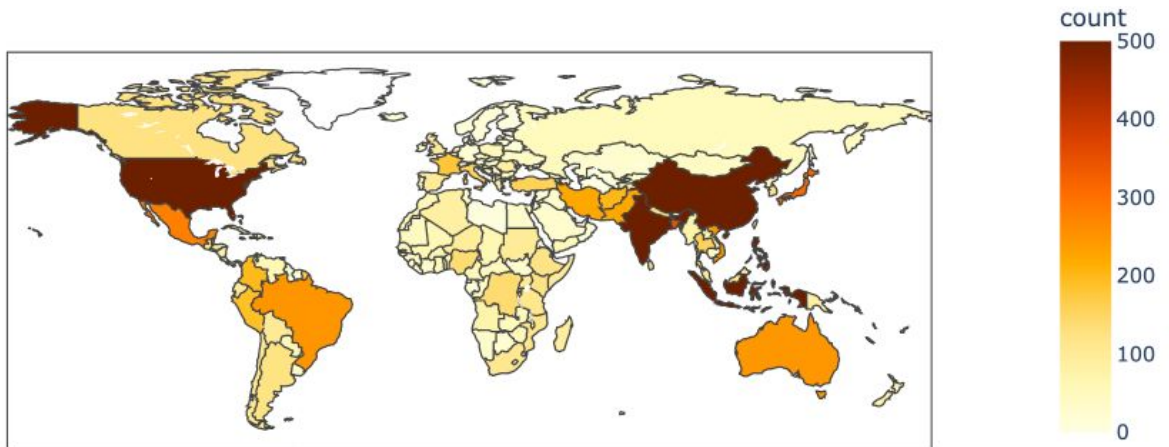
And where is Carmen Sandiego?

Is there a geographic component to the occurrence?
Around equator, or certain elevations or by a specific geographic features like ocean
Land mass normalization?

However, aggregation of the number of disasters by country suggests that there is no correlation
between geographic location and the frequent occurrence of natural disasters. The same continent
may include countries with both high and low numbers of natural disasters.

# Does the increase relate to pollution?

Emissions vs Disaster Count
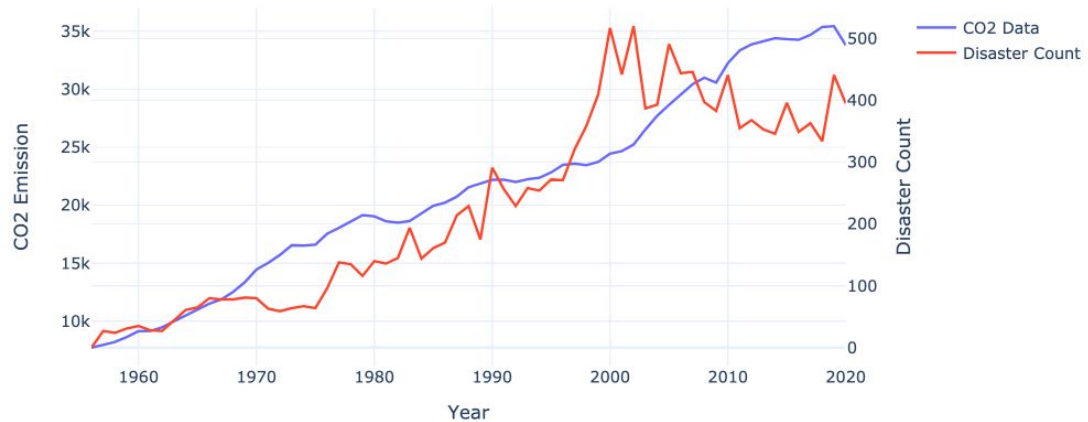
The trending of emissions and disaster events suggests there is a relationship between the rise in CO2 emissions and the rise in the number of natural disasters.

The results are consistent with findings of focused research that address the causes of increased weather events (AMERICAN METEOROLOGICAL SOCIETY, 2017).

this increase of weather events is due to man-made pollution is the first step in discussing who's culpable and in turn who should be held accountable.

b. Are rich countries polluting more than poorer countries?



2016 GHG Emissions per capita vs GDP per capita (Semi-Log)
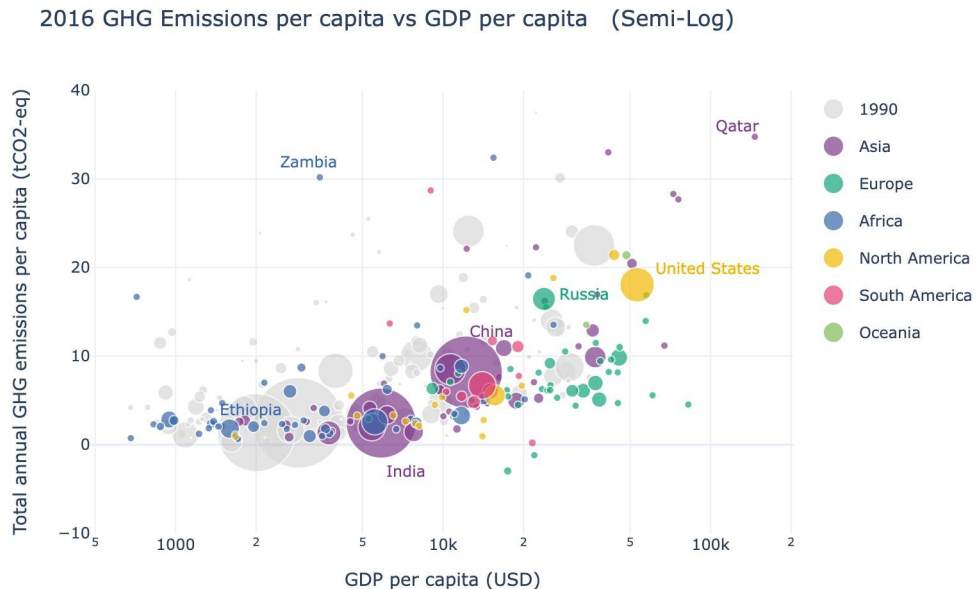
From our findings, we believe that richer countries are generally polluting more than poorer countries. One of the key graphs is 2016 GHG emissions vs GDP per capita. The total GHG emissions, which includes land use change and forestry. GDP per capita is used to measure the wealth of countries. In the graph, the size of the dots represent the size of the population. The majority of the countries are clustered around 10~25k GDP per capita and emit around 5~10 tCO2-eq. Compared to 1990 in grey, many countries in Asia became wealthier as they became the world's factory, but also increased in emissions. Europe maintained emissions around 5~10 tCO2. Most of Africa has both low emissions and GDP per capita.

However, it becomes apparent that rich and poor is subjective phrase and GDP can be very misleading. UN Summit debates target this argument towards major countries such as China, Europe, and USA. However, China has a high GDP yet their per capita GDP is very low due to their large population. India also has among the highest GDPs, but their per capita GDP is very low. An interesting observation is Qatar, which is on the extreme end and has highest emissions AND GDP per capita due to having oil and gas as their main economic sector. But when considering their small population, their GDP would not be as high as the Big5 nations.

Secondly, the correlation between emissions and wealth is not as strong as the CO2 emissions graph which we have included in our appendix. There are countries such as Zambia that have extremely high emissions yet does not have a high GDP per capita. And the reason behind this is that there is many other factors independently influencing GDP and emissions. To have all high-polluters take monetary responsibility for their pollution may not be practical for all countries. And to only charge rich countries would not be very reasonable either.
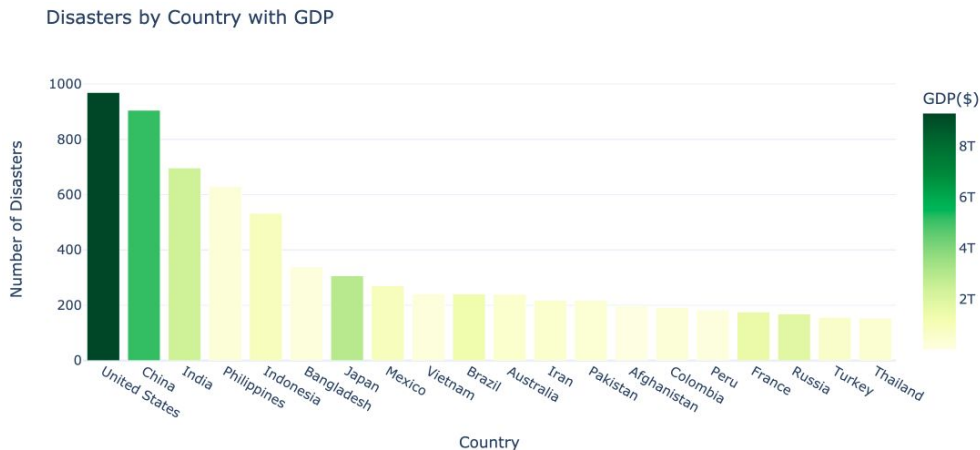
Based on our earlier analyses, we have no definite answers on should rich nations compensate poorer nations for severe climate change, but have policy considerations. Earlier we determined that nations with higher GDP are polluting more than the poorer countries.

However, there are a number of factors that may evolve. The world is increasing in both GDP and CO2 emissions so the definition of wealth and high polluting countries may change over time. For example, if countries with lower GDP increase CO2 and GHG emissions at what's considered 'high levels', will they be accountable as well?

In terms of compensation, wealthy and poor (high vs. low GDP) are too general as categories. We saw earlier that there are countries with low GDP and high emission rates such as Ukraine. As shown in this graph, countries with highest GDP (i.e. The United States, China, India) also rank the highest in the number of natural disasters and also are feeling the pain of climate change. Thus, the variable, GDP, on its own does not define how much countries should contribute to climate change.

Conclusion: **How does severe weather experience compare between high- and low- polluters in the world?**

Increase in pollution + severe weather
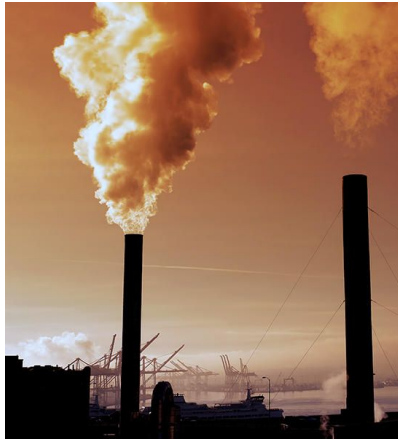
**High GDP countries pollute more**

GDP ≠ compensation

To summarize our main findings from the research questions,

-   Severe weather is a good indicator for pollution. In our graphs, CO_2 emissions rose with disaster counts.
-   High GDP countries were polluting more than lower GDP countries. High GDP countries contributing to high pollution are the United States, China, Russia, Japan and India.
-   Finally, we found that GDP was a too general variable to determine compensation. High GDP countries were also experiencing more disasters. Additionally, there were countries with low GDP (i.e. Ukraine) that had high CO_2 and GHG emissions.

GDP should not be used as the sole variable in determining compensation . Thus, we recommend incorporating these observations to consider better factors for accountability in future studies.

Appendix

2016 CO2 Emissions per capita vs GDP per capita (Semi-Log)
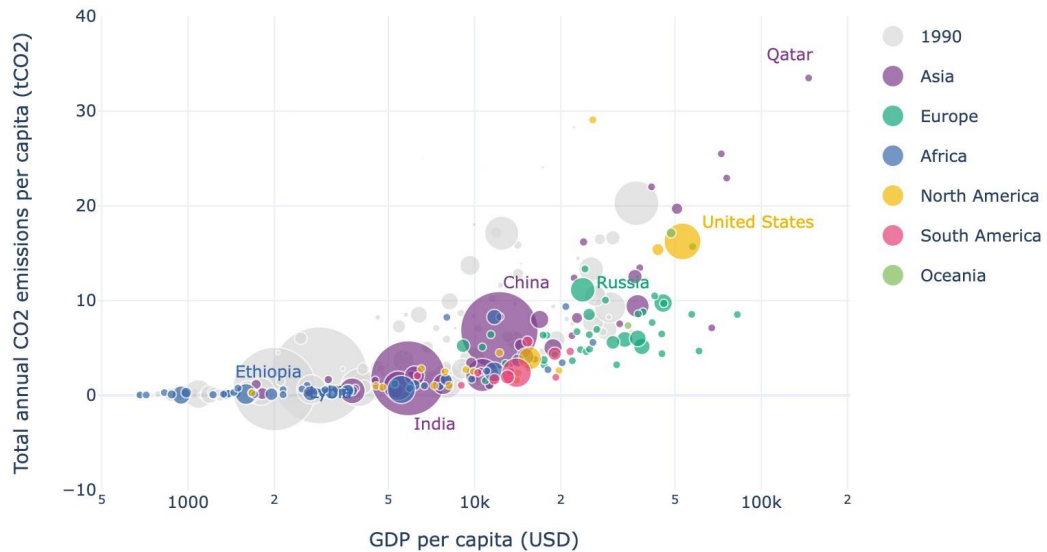
Figure 6. CO2 emissions per capita vs GDP per capita (Semi-Log): *Annual production-based emissions of carbon dioxide (CO2), measured in tonnes per person. This is based on territorial emissions, which do not account for emissions embedded in traded goods. GDP per capita with population uses GDP measured in international-$ using 2011 prices to adjust for price changes over time (inflation) and price differences between countries.*

Above is a comparison of 1990 and 2016's annual CO2 emissions per capita vs GDP per capita. In the span of 20 years, several Asian countries have sky-rocketed in both CO2 emissions per capita and GDP per capita. Europe's emissions have concentrated in the range of 5 to 10 tonnes of annual CO2 emissions. These two graphs consistently demonstrate that most of Africa has the lowest emissions followed by South America and North America.

CO2 emissions over years per country