Global Tapestry: Charting the Nexus of GDP, Food Security, and Climate Change

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Introduction & Background:

The global landscape is constantly evolving, marked by economic fluctuations, changing food production and consumption patterns, and the pressing issue of climate change. Understanding the interplay among these dynamics is crucial for informed decision-making, policy formulation, and sustainable development. In our project, we aim to shed light on these intersecting dynamics by visualizing data related to national GDP (Gross Domestic Product), food export-import indices, and CO2 emissions across various nations over several years and uncover correlations, regional patterns, and long-term trends. Our motivation for selecting this topic stems from a deep concern for the state of our planet and a curiosity to explore the relationships between economic prosperity, food security, and environmental sustainability. Ultimately, our work benefits society by fostering informed decisions, supporting sustainability efforts, and addressing food security challenges. Sources such as IPCC, “The EAT-Lancet Commission on Food, Planet, Health etc.

Datasets:

The data sources provided are from the World Bank Group (WBG), a renowned international financial institution. The data was created to monitor and analyze various aspects of global economic and environmental development. It serves purposes such as assessing economic growth (GDP growth), understanding food trade dynamics (food imports and exports), and monitoring climate change indicators.

WBG data serves as an open-source data portal, that comes from the statistical systems of member countries, and the quality of global data depends on how well these national systems perform. The WBG works to help developing countries improve the capacity, efficiency, and effectiveness of national statistical systems.

The Bank uses trust funds, a financing arrangement set up with contributions from one or more development partner, to complement core funding from the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), and the International Finance Corporation (IFC), in support of the WBG’s goals.

Data Timeline – Includes data from 1960s-2020s for ~266 countries, has the food export, import, GDP & CO2 emissions indices.

We plan to use the WBG's dataset on nations' GDP, Food Export/Import index and Climate change metric such as CO2 emissions.

Datasets-

- Food Imports
- Food Exports
- GDP Growth
- Climate Change

Variables used in the dataset are as described below: -

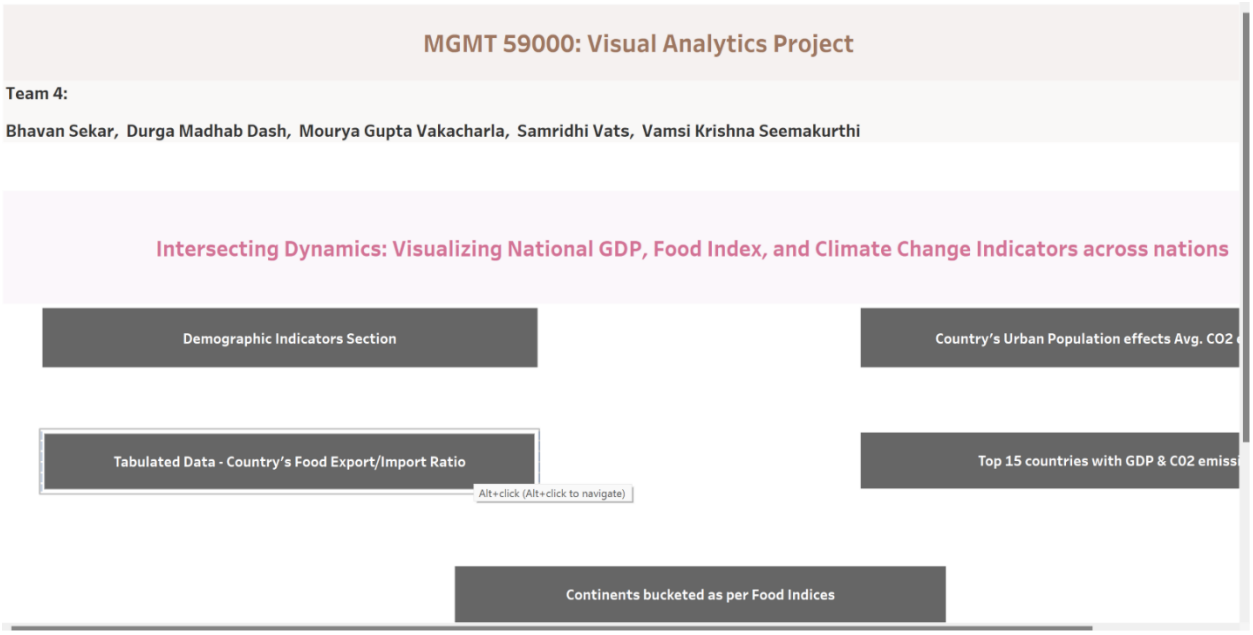
- Food imports: - This variable measures the proportion of a nation's merchandise imports that consist of food products, indicating its reliance on international food sources.
- Food exports: - This variable quantifies the percentage of a country's merchandise exports that comprise food items, reflecting its role in global food trade.
- Continent: - Variable representing the continents WBG's members belonged to.
- Country: - WBG's member countries from which data is collected and represented in graphs.
- Year: - Data collection timeline from 1960s to early 2020s.
- Urban Population Growth: - This variable represents the global population growth annually.
- CO2 Emissions: - Percentage of carbon dioxide emissions from gaseous, solid, and liquid fuel consumption in a year over time.
- Food Export/Import Ratio: - Ratio of food export to import for a country.
- GDP: - This records GDP of member countries for each year data has been collected.

This dataset helps us understand the relationship between carbon emissions and GDP, revealing patterns in how economies affect the environment. They shed light on the interplay between food index, GDP, and trade deficits, offering insights into economic, food, and trade dynamics. These visual indicators will provide valuable insights for informed decision-making, policy formulation and sustainable development.

Data Story:

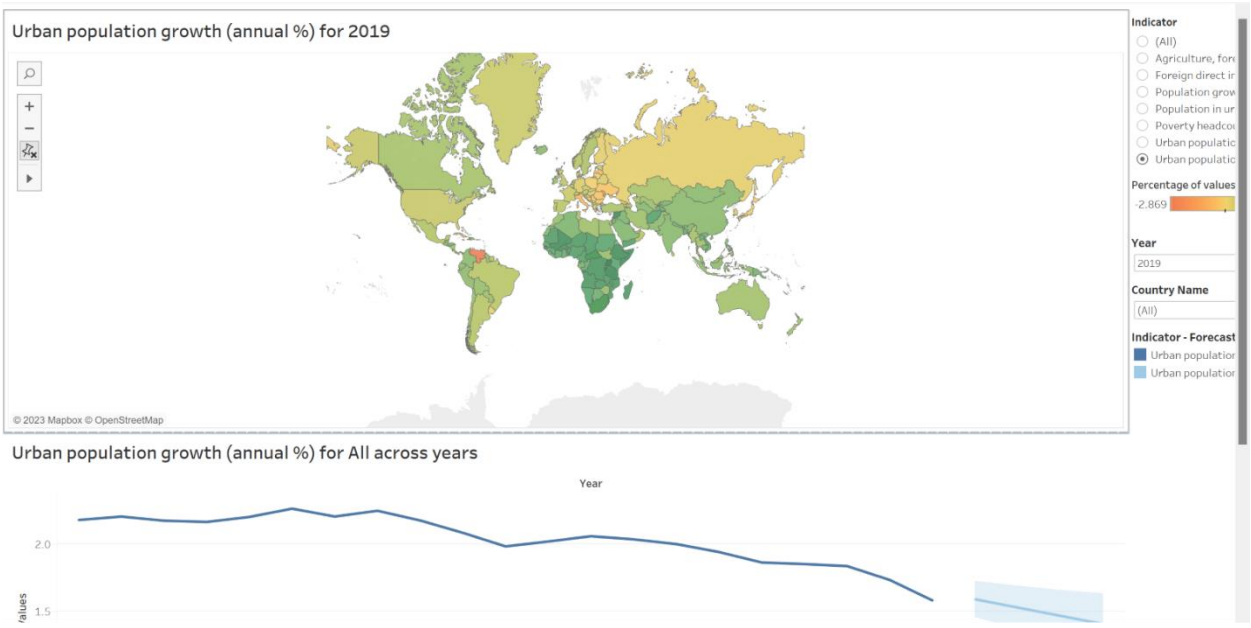
We have presented an amalgamation of climate change indicators, GDP, and food indices for visualizing the correlation between these features. Our objective is to identify the key stakeholders in the climate crisis and segment the contributors: By absolute contribution/ By per capita contribution.

- **HOME**



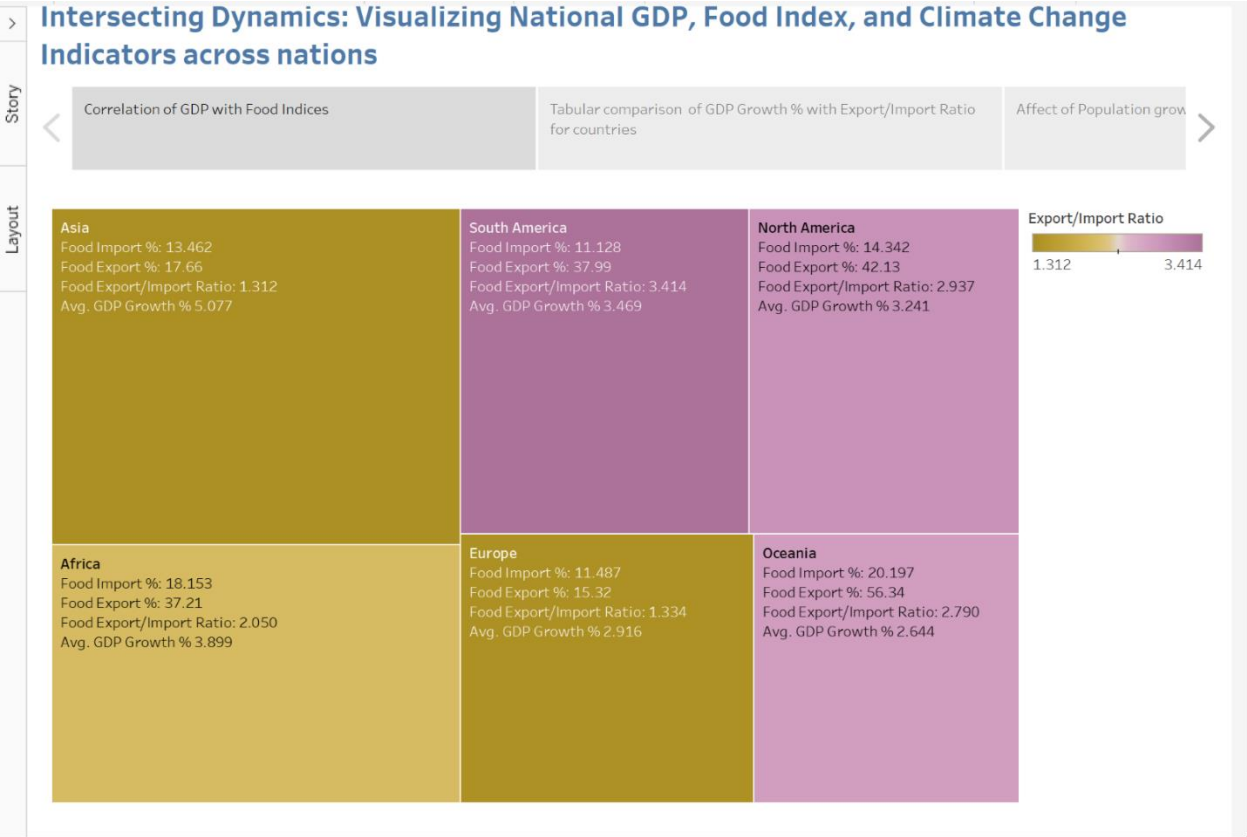
This dashboard serves as an index of all the other dashboards and visualizations. This is intended to organize all the visualizations.

- **Demographic Indicators change pattern over time**



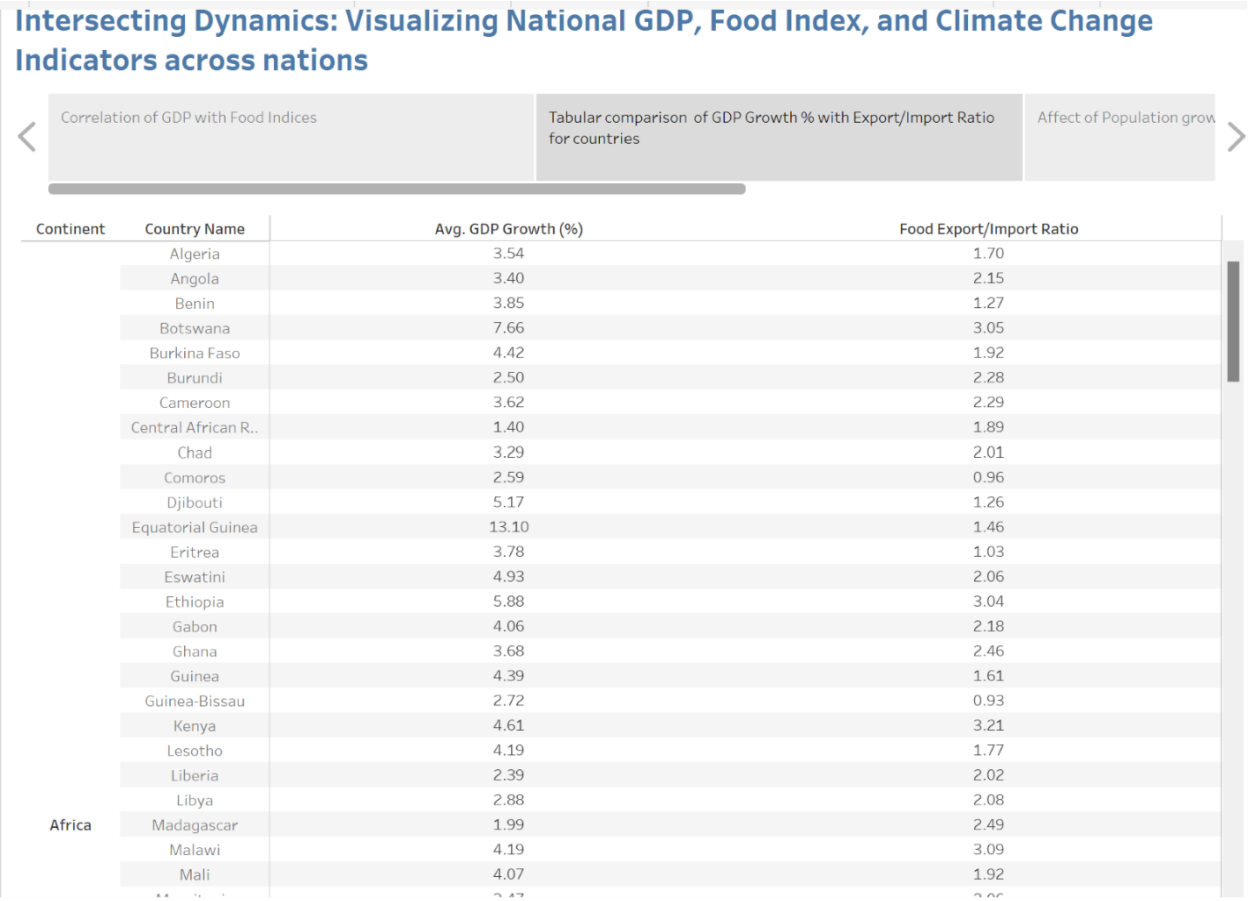
This dashboard's objective is to present a comprehensive preliminary analysis of the key demographic indicators of climate change. The indicators can be selected for multiple years and different countries can be selected for visualizing the trend over year on the line chart below. This dashboard's objective is to present a comprehensive preliminary analysis of the key demographic indicators of climate change. All the demographic indicators have percentage values. For example: Population growth percentage.

- **Correlation of GDP with Food Indices**



The objective of this chart is to see if there are any significant patterns in the ratio of exports and imports and the GDP of a country. This presents the issue of multicollinearity if any in trying to understand the dynamics of climate change indicators with respect to GDP and food index. For a macro level understanding, we have presented the aggregated correlation chart for each continent. This reduces the bias of the presentation (extreme values in GDP and import-export ratio and misrepresented relationships) and increases visualization ease. We can see that there is no clear-cut pattern in the average GDP growth of a continent that can be attributed to the export import ratio. This suggests that it is useful to try to understand climate change with respect to two independent features: GDP and food index. The correlation chart uses the aggregated average percentage of all the countries in a continent for all relevant measures: GDP, food import/food export, food import and food export.

- **Tabular comparison of GDP Growth % with Export/Import Ratio for countries**



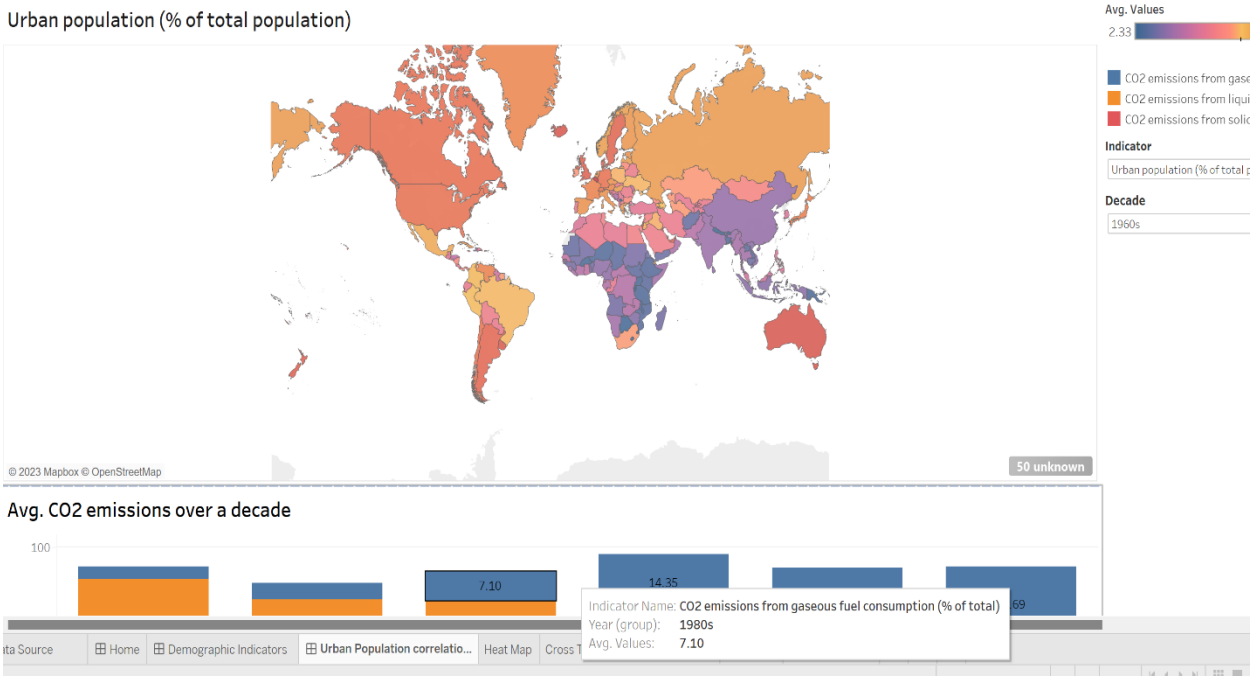
Continent	Country Name	Avg. GDP Growth (%)	Food Export/Import Ratio
	Algeria	3.54	1.70
	Angola	3.40	2.15
	Benin	3.85	1.27
	Botswana	7.66	3.05
	Burkina Faso	4.42	1.92
	Burundi	2.50	2.28
	Cameroon	3.62	2.29
	Central African R..	1.40	1.89
	Chad	3.29	2.01
	Comoros	2.59	0.96
	Djibouti	5.17	1.26
	Equatorial Guinea	13.10	1.46
	Eritrea	3.78	1.03
	Eswatini	4.93	2.06
	Ethiopia	5.88	3.04
	Gabon	4.06	2.18
	Ghana	3.68	2.46
	Guinea	4.39	1.61
	Guinea-Bissau	2.72	0.93
	Kenya	4.61	3.21
	Lesotho	4.19	1.77
	Liberia	2.39	2.02
	Libya	2.88	2.08
Africa	Madagascar	1.99	2.49
	Malawi	4.19	3.09
	Mali	4.07	1.92

In continuation of the previous chart, this crosstab is intended to provide a more detailed analysis of the GDP growth vs Food export import ratio. From the crosstab we see that the dispersion of the export-import ratio with respect to the GDP is more in Africa compared to other continents. This suggests that there exists some weak connection between the export-import ratio of a country and GDP if the region is economically stable.

The key objective of this chart is to demonstrate the distribution of types of CO2 emissions on the stacked bar chart based on climate change indicators. The filled map denotes the indicator values for each country. We notice here that for the higher values of indicators that denote positive climate change contribution, the distribution of the types of CO2 emissions becomes more even. For the others, the gaseous emissions are exceptionally low in percentage contribution. It is also interesting to note that gaseous emissions cause more immediate harm to the environment as they are not easily controllable. This suggests that countries that have higher values of key demographic and/or non-demographic climate change indicators have an inherent obligation towards curtailing their contribution to climate change.

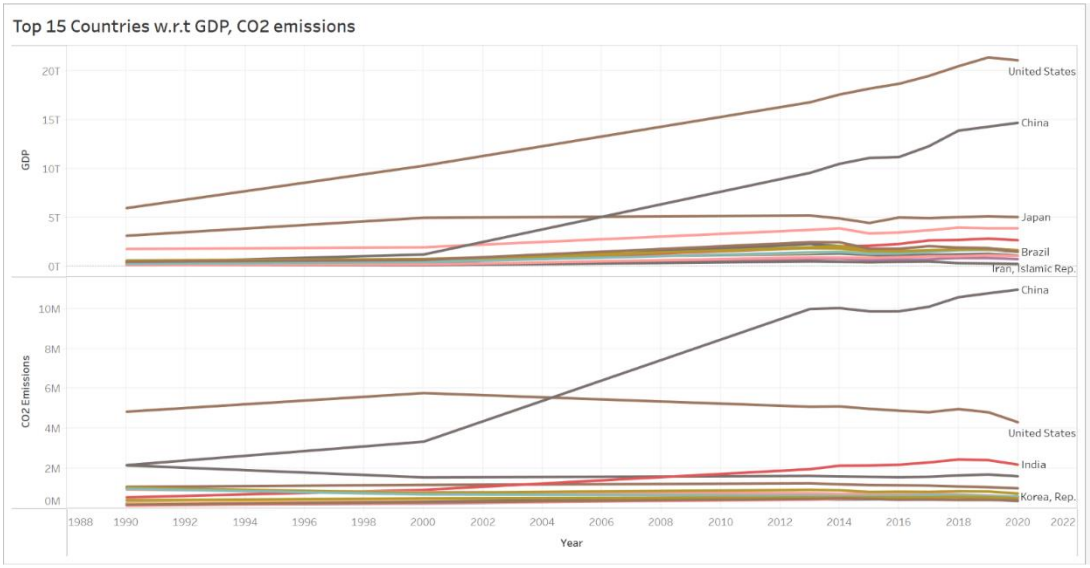
All the variables are percentage values obtained from the dataset for the relevant measures.

- **Urban Population correlation with Avg. Co2 emissions**



This dashboard's objective is to present the distribution of carbon emissions with respect to key positive climate change indicators. All the values of the distribution are visualized in percentage values. The values of the indicators are also in percentages. We notice that for countries with higher values of positive climate change indicators the distribution of the types is more even. For the other countries, the gaseous emissions are very less. It is interesting to note that gaseous emission is the most uncontrollable and dangerous form of emission. This suggests that countries which have higher values of demographic and non-demographic indicators of climate change have an inherent responsibility to curtail their emission or manage their resources.

- **Top 15 countries in terms of GDP & Carbon emissions**



The purpose of this graph is to visualize the correlation between GDP and CO2 emissions. The unit of CO2 emission and GDP is Kilo ton and Trillion dollars, respectively. This is the only chart which visualizes absolute values. as We look at the top 15 countries in terms of GDP (significant countries that can contribute to climate change). We see that there is a significant rise in CO2 emissions with the rise in GDP. This is especially true for countries like China and India that have been rapidly developing countries. We can also see that the US has risen in GDP but has controlled CO2 emissions significantly. This suggests that with sensible governance after a certain level of development has been achieved, emissions can significantly be controlled. However, we must scale the contribution of countries by population while making conclusions about contribution. The USA has a much less population compared to India for example but emits more CO2 than the Indian subcontinent. Though China emits significantly more CO2 than US, its population is much more than twice of USA. Hence the question of "who is responsible" and "how much" can intuitively been understood from the visualizations both in terms of absolute contribution and in terms of moral obligation.

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Summary and Conclusions:

Our initial aim was to work with datasets that lacked direct correlations, incorporating a range of factors including GDP, food exports and imports, CO2 emissions, and climate change. However, upon conducting a more comprehensive analysis of the data, we have uncovered a nuanced reality. While it may seem that each factor does not exert complete control over the others, there is indeed a discernible level of influence present, particularly evident when we visualize the data.

For instance, when examining the relationship between GDP and CO2 emissions, it is typical to observe that as a country's GDP increases, so does its CO2 emission rate. However, exceptions to this pattern exist, as exemplified by the case of the USA, where political reforms have disrupted this anticipated trend. Furthermore, we have noted instances where certain attributes have influence in specific regions, while they do not in others, as demonstrated by our cross-tabulation.

In summary, our data enables us to uncover relationships among these diverse variables. Yet, it is imperative to exercise caution when attributing causation to any single factor, as numerous other variables are contributors to the observed outcomes. This underscores the complexity of comprehending the true drivers of these phenomena.

For the actionable insights, we conclude that China is the largest contributor to climate change in terms of absolute value and US is the largest contributor in terms of moral obligation (Per capita emissions) from the insights of the line chart and the stacked bar chart. We conclude that there is a meaningful relationship between GDP and climate change but also that good policy of governance can offset the effect of prosperity or affordability on climate change as is evident in the case of USA.