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Rice University Data Analytics & Visualization Bootcamp

Is GDP affected by Annual Changes in Precipitation & Temperature

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For this project we analyzed Gross Domestic Product (GDP) data for countries across the globe in an attempt to determine the effects of variations in temperature and precipitation on said GDP. After gross domestic product data was weighed against both annual temperature changes, and annual precipitation changes for all countries with available data across the specified time frame (2005-2015), we looked into the top ten countries whose GDP percentages were dominated by either Agriculture, Industry, or Service. A breakdown of said countries is shown in Table 1 below.

**Table 1: GDP Dependance Data**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Agriculture Dependent GDP** | | **Industry Dependent GDP** | | **Service Dependent GDP** | |
| Sierra Leone | 60.70% | Angola | 61.40% | The Bahamas | 90.00% |
| Chad | 52.30% | Kuwait | 58.70% | Malta | 88.70% |
| Guinea-Bissau | 50.00% | Northern Mariana Islands | 58.10% | Barbados | 88.70% |
| Comoros | 47.70% | Timor-Leste | 56.70% | Luxembourg | 86.90% |
| Central African Republic | 43.20% | Brunel | 56.60% | Monaco | 86.00% |
| Mali | 41.80% | Equatorial Guinea | 54.60% | Marshall Island | 85.70% |
| Niger | 41.60% | Azerbaijan | 53.50% | Cyprus | 85.50% |
| Sudan | 39.60% | Libya | 52.30% | Seychelle | 83.70% |
| Burundi | 39.50% | Iraq | 51.00% | Lebanon | 83.00% |
| Ethiopia | 34.80% | Republic of the Congo | 51.00% | St. Lucia | 82.80% |

Agricultural GDP output is “the process of producing food, [feed](https://en.wikipedia.org/wiki/Fodder), [fiber](https://en.wikipedia.org/wiki/Fiber) and other goods by the systematic raising of plants and animals”¹. Industrial GDP output “is the segment of economy concerned with production of goods (including [fuels](https://en.wikipedia.org/wiki/Fuel) and [fertilizers](https://en.wikipedia.org/wiki/Fertilizer))”¹. And lastly, Service GDP is “the non-material equivalent of a [good](https://en.wikipedia.org/wiki/Goods). Service provision is defined as an economic activity that does not result in [ownership](https://en.wikipedia.org/wiki/Ownership), and this is what differentiates it from providing physical goods”¹.

The specific questions asked and answered are shown below:

1. How temperature changes affect GDP in countries of interest.

* Look for discernable trends in GDP with respect to temperature fluctuations over a 10-year period.

1. How annual precipitation affect GDP in countries of interest.

* Look for discernable trends in GDP with respect to annual temperature over a 10-year period.

1. How weather affects GDP in Agriculturally based economies

* Analyze temperature and precipitation changes for countries whose GDP is predominantly agriculturally based.

1. How weather affects GDP in Industrial based economies

* Analyze temperature and precipitation changes for countries whose GDP is predominantly industry based.

1. How weather affects GDP in Service based economies

* Analyze temperature and precipitation changes for countries whose GDP is predominantly service based.

RESTful API was used to pull all the country ISO3 codes for consistency in nomenclature throughout this analysis. Both precipitation and temperature data were pulled from World Bank’s site, and the GDP Dependance data came from the Wikipedia article: ‘List of countries by GDP sector composition’. Nominal GDP sector composition was used rather than the GDP Purchasing Power Parity composition to determine the top ten countries for each GDP sector, shown in Table 1 on the previous page. Data was merged and multiple countries were omitted from our analysis due to insufficient data.

Emeka and Kiran looked into the relationship between GDP and average annual temperature and precipitation across all countries during the specified timeframe (2005-2015). Said data was then analyzed to determine possible correlations between weather and gross domestic product.

Sadie, Nick, and Charles examined the relationship between weather and specific countries whose GDP sector composition was dominated by either Agriculture, Industry, or Service during the specified timeframe (2005-2015). Said data was then analyzed using the Pearson correlation to show if there was a positive or inverse relationship.

Little to no consistent support for the hypothesis that weather effected GDP could be determined from the data analysis and visualization performed on the data set as a whole. An assumption could be made that there were too may outside variables effecting the overall GDP data, and by only looking at data on an annual basis, rather than quarterly—we could not see a noticeable effect.

Only when drilling down into GDP sector composition subsets, could some correlation be seen, but even then, it was minimal. Industrial and Agricultural dependent economies showed no connection between GDP and changes in temperature and precipitation. Service based economies (dependent on tourism) suggested some type of relationship between GDP and temperature, but no correlation between GDP and precipitation. Modern changes in irrigation (micro-irrigation, drip-irrigation), and the use of drought tolerant crops might explain the lack of correlation between GDP and precipitation for Agricultural countries.

Additionally, there could be some correlation between precipitation and GDP if we drilled down into the Agriculturally dependent dataset, looking at the growing season precipitation data only or possibly looking at quarterly GDP statistics. Furthermore, looking at countries that bordered large bodies of water might show a marked effect from precipitation on GDP.

Lastly, countries experiencing Civil and/or Economic unrest, government sanctions and/or corruption during the specified time frame, or economies dependent on black market crops (Afghanistan’s Opium Crop) should be filtered out for more consistency in the overall analysis of changes in GDP.

**References:**

1. Wikipedia contributors. "List of countries by GDP sector composition." Wikipedia, The Free Encyclopedia. Wikipedia, The Free Encyclopedia, 14 Sep. 2020. Web. 22 Sep. 2020.