

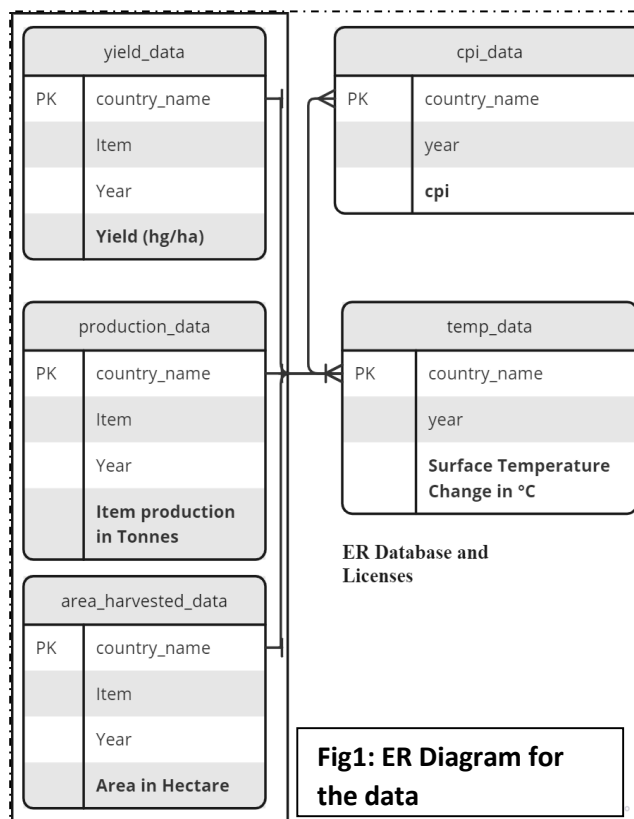
Climate Change and its burn on Pocket - Cost of Living Crisis

04 July, 2024

1. Motivation

Climate change is a known enemy today for the world and it poses an existential threat to humanity across the world. Changing weather patterns, disappearing spring season, and unbearable summers have clarified the existence of the problem. Falling annual precipitations, ever-increasing droughts, and prolonged heat waves have impacted various sectors of the economies ranging from crop production and availability of drinking water to governments failing to achieve the climate targets. The most impact is borne by the people at the bottom of the financial pyramid, which leads to a cost of living crisis. This project aims at finding facts from the data collected from various open sources and derive actionable insights which will give us a peek into what to expect from the future. The goal is to find trends that can help us mitigate the risks posed by climate change and ensure the availability and affordability of the basic needs for each and every person on the planet.

2. Data Sources



2.1. FAOSTAT – Food and Agriculture Organization of the United Nations

- Data Format: CSV
- URL: [Africa](#), [America](#), [Asia](#), [Europe](#), [Oceania](#)
- License: CC BY-NC-SA

This FAO dataset provides an extensive overview of worldwide crop production statistics from 1961 to 2019. I have filtered data of staple foods across countries of the world to better understand the trends that impact Cost of living across the globe. The data has three major attributes to understand the effects the cost of living across the globe:

Indicator	Description
Yield(Hg/Ha)	Item produced per hectare, expressed in terms of hectograms.
Item Production (Tonnes)	Amount of item produced in I given year
Area (Hectare)	Area of the land cultivated in that year

2.2. Kaggle

- Data Format: CSV
- URL: <https://www.kaggle.com/datasets/mdazizulkabirlovlu/all-countries-temperature-statistics-1970-2021/data?select=all+countries+global+temperature.csv>
- License: CC BY-NC-SA

This data is provided by the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) and is based on publicly available GISTEMP [1] data from the National Aeronautics and Space Administration Goddard Institute for Space Studies (NASA GISS). This dataset provides information on changes in global surface temperature across all countries from 1970 to 2021

2.3. World Bank Open Data - Free and open access to global development data

- Data Format: CSV
- URL: <https://api.worldbank.org/v2/en/indicator/FP.CPI.TOTL?downloadformat=csv>
- License: CC-BY 4.0 - More info can be found [here](#).

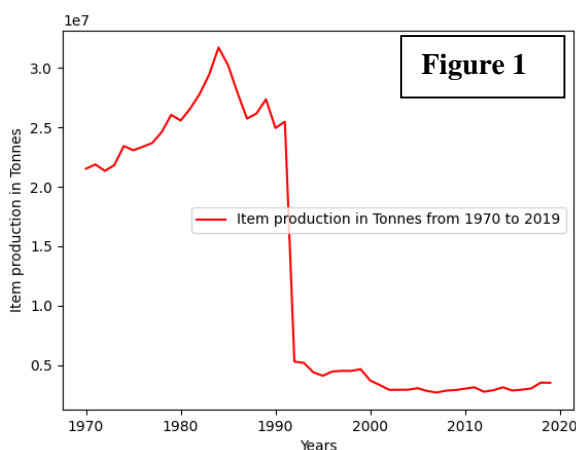
The World Bank as my data source due to their extensive data on global economic indicators. Their reputation for reliable and comprehensive data makes them an ideal source for my project. This database provides monthly food price inflation estimates for the countries around the globe. The relation between the food price inflation of countries and its dependence on production yields and temperature can be analysed using the data.

3. Analysis – Deep dive into the data

The “CPI” and “Temperature” data set have been utilized in its entirety but the crop data set has been trimmed down to suit the problem statement. Consumer Price Inflation (CPI) is dependent on the yield of the staple food products of any region. Due to diversity and different consumption patterns across the globe the staple foods of various regions vary a lot and I have chosen the below mentioned products for analysis:

Region	Staple foods
Africa	Yams, Bananas, Sweet potatoes
America	Dry beans, Green beans, Sweet potatoes, Tomatoes, Dry Onion, Green Onion
Asia	Rice, Wheat, Soybeans, Peanuts
Europe	Strawberries, Raspberries, Blueberries, Cranberries, Dates, Plums, Millet
Oceania	Yams, Potatoes, Sweet potatoes, Coconuts

3.1. What are the trends in the production of staple food items (Wheat, Rice, Potatoes etc.) across the globe? How the yield (production per hectare) has changed over the years (1970-2019)?



The combined production of staple foods has come down significantly from 1970-2019. The production levels peaked in 1980s as evident from graph on the left. Post 1990s there was a severe decline in the overall staple food production across the globe. This can be attributed to major global events such as “outbreaks of pests and diseases that severely impacted agriculture, crop diseases such as wheat rust and maize streak virus caused considerable damage.” The analysis also shows that staple food production has never been able to regain the growth momentum post the decline and natural disasters and global warming are a huge factor for the same (discussed later).

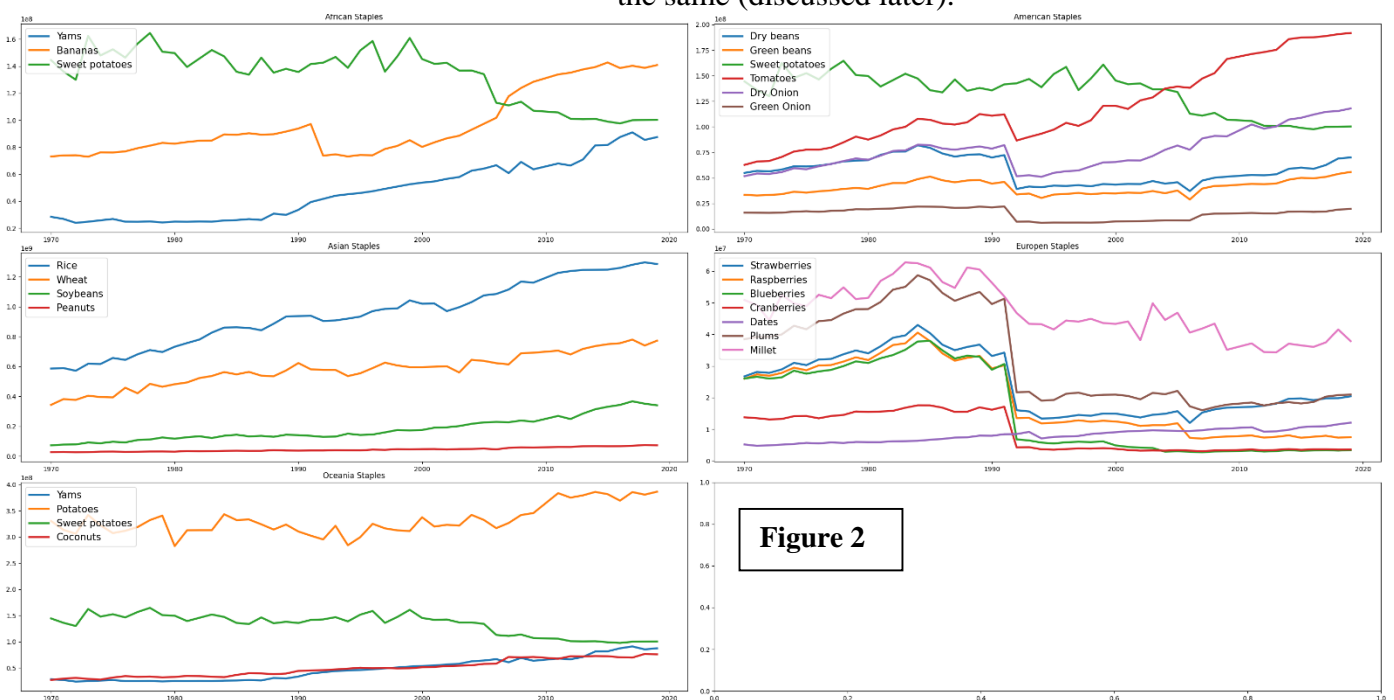


Figure 2 depicts how yield per hectare (Hg/Ha) of staple food varies in the various regions of the world. Yams, which is a major source of carbohydrates in African and Oceanian countries, has seen a very minor growth in its yield across the globe. Other staple food items like sweet potatoes, beans, onions and coconuts have suffered a great fall in their yields across all the regions including African, American and Oceanian countries. Some food items like Bananas, Rice, Wheat and Tomatoes have seen an expansion in the yield as well. This is region specific expansion as Rice and Wheat are majorly grown in Asian countries. This can also be related to the Surface Temperature change (in °C) factor over the period 1970-2019 (**Figure 3**). The most hit region is European countries where yield of all the staple foods Berries (Strawberries, Cranberries, Blueberries and Raspberries) has significantly declined over the period. Plums and Millets which have a permanent place on European kitchens are also facing a steep fall in the production yields, with an exception of Dates, which have shown a slight growth in the yields.

3.2. Trends and correlation between production yields and the consumer price inflation (CPI) from year 1970-2019?

3.3. How temperatures have flared up from 1970 – 2019? Has rising global temperatures impacted the global crop production yield?

Figure 3

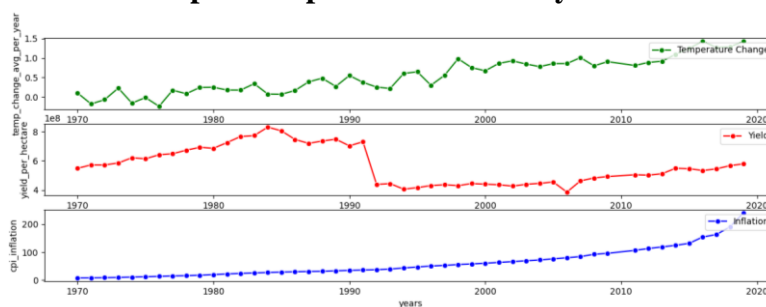


Figure 3 shows that there is a gradual increase in the average global Consumer Price Inflation(CPI) from 1970 to 2019. Also, the figure puts an emphasis on the average global production yields over from 1970-2019 and yield per hectare (Hg/Ha) of staples foods, which has been struggling to rise, and shows a negative correlation between the average global CPI and downfall in yield(Hg/Ha). **Figure 4**, on the left, shows trend of CPI and Average Surface Temperature Change (°C) across different regions of the globe. While it is a general phenomenon that the average global Surface Temperature Change (°C) has risen by almost 1.5°C from 1970 to 2019, this change is very different across different regions of the globe. Change is lowest (around 1°C) in Oceanic countries like Australia while it is as high as 2°C across European countries. The Asian countries suffer a mild change of around 1.5°C in the average Surface Temperature Change (°C). This can be related to the steep decline in yields of all the staple food items in European countries as discussed earlier (**Figure 2**). Also, mild temperature change in Asian countries has attributed to rise in yield of items like Wheat and Rice.

It is a noticeable trend in the **Figure 4** that less Surface Temperature Change (°C) attributes to less CPI inflation. In Oceania region, the CPI numbers have gradually increased by 120 percentage points, while for African region the inflation is much higher and hits a peak of 500 percentage points. CPI for European, American and Asian region hover around 150 percentage points over the years 1970-2019. Although, the Surface Temperature Change (°C) is mild (1.5°C) for African region the inflation numbers tell us a different story. Inflation

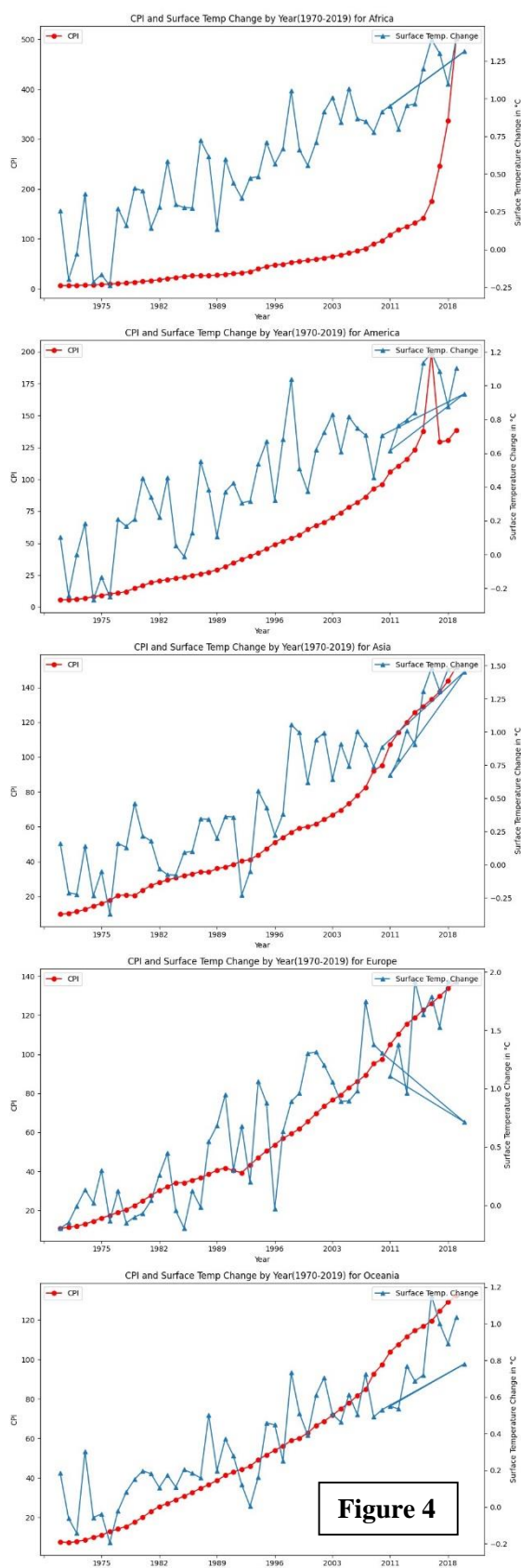


Figure 4

should have been highest in European region as there is highest Surface Temperature Change ($^{\circ}\text{C}$) but this is a drawback of this analysis where we have not considered the geopolitical scenarios and other global influences on the CPI numbers.

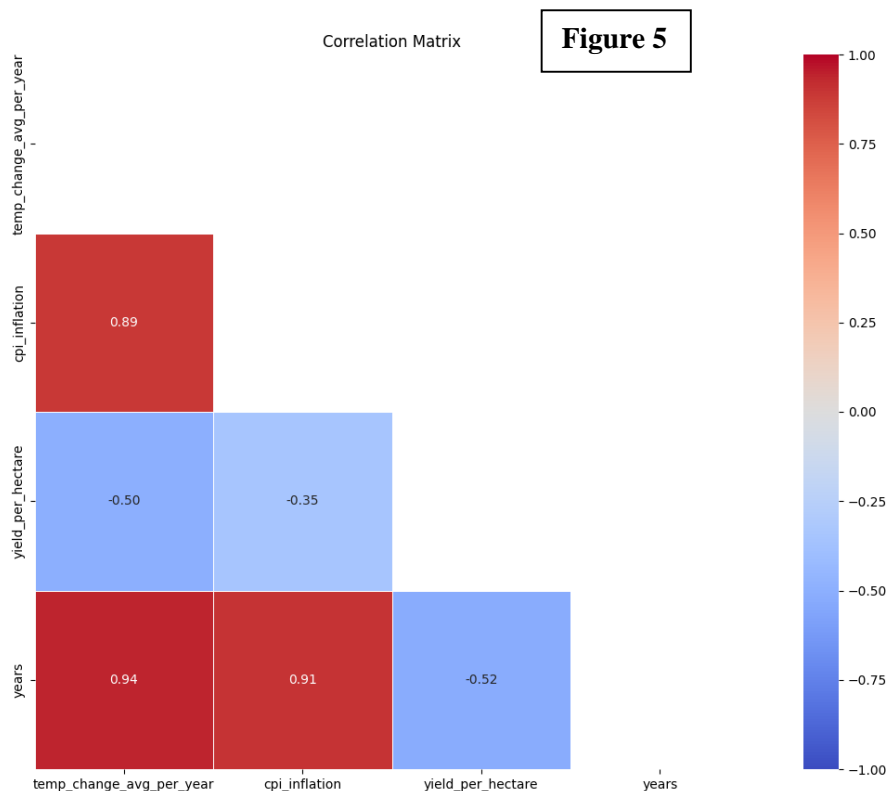


Figure 5 summarizes the questions in context of this report. **Yes**, there is a very high correlation (+0.89) between Surface Temperature Change ($^{\circ}\text{C}$) and Consumer Price Inflation across various regions of the globe. The flaring temperatures have impacted yield per hectare(Hg/Ha) in all the regions and it is evident by negative correlation (-0.50) between them. **Yes**, as yield per hectare(Hg/Ha) goes down, the CPI inflation goes up, as they show as negative correlation (-0.35).

Finally, with passing years, the overall average global Surface Temperature Change ($^{\circ}\text{C}$) have increased (+0.94), the average

CPI around the global regions has increased which has severely affected lives (+0.91) and overall yield per hectare (Hg/Ha) has declined (-0.52).

4. Critical Reflection and Limitations of the Report

4.1. Limitations of the Study

During the course of this study, several limitations were encountered that might have influenced the findings.

- **Missing Data in Temperature Dataset:** There were a few missing values in the temperature change dataset. While these gaps were not extensive, they could potentially influence the accuracy of the correlation analysis.
- **Potential Confounding Variables:** The report mainly concentrated on the direct correlation between temperature changes and its impact consumer price inflation and yield per hectare(Hg/Ha), without thoroughly examining other potential influencing factors such as socio-economic policies, regional conflicts, and global market dynamics. These variables could significantly impact food prices and potentially confound the relationship with temperature changes. An example of which is CPI in African regions.

These limitations highlight areas for future research and the need for more comprehensive data collection to deepen our understanding of these complex dynamics.

4.2. Questions for Further Research

While this research has provided valuable insights, it also opens up several areas for further exploration. The following questions remain unanswered and could be the focus of future studies:

- Exploring Additional Influencing Factors
- Impact of Climate Change Policies

These questions could guide future research efforts, deepening our understanding of the complex factors that influence food price inflation and how they interact with environmental changes.