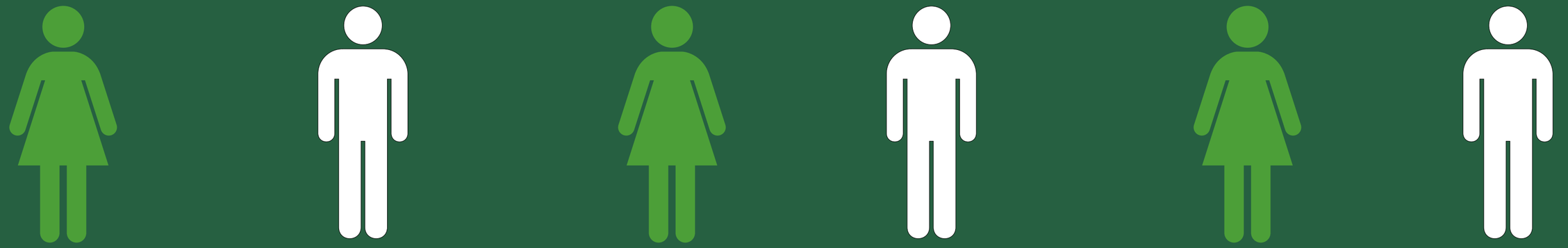
# PREDICTING FOOD PRICES IN KENYA

SokoSmart Analysts

# SOKOSMART MEMBERS



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# Overview

- This project is dedicated to addressing the critical issue of food security and pricing challenges within Kenya's agricultural sector.
- With over 80% of the Kenyan population relying on agriculture for their livelihoods, the project aims to provide comprehensive solutions to empower both farmers and retailers.
- By analyzing extensive datasets, including food prices, inflation rates, and weather patterns, the project seeks to uncover key trends and relationships, segment regions, conduct geospatial analyses, and investigate correlations.
- Additionally, it endeavors to develop predictive time series models for food price forecasting and offer actionable recommendations to stakeholders.

# Problem statement

How can the application of advanced data science methodologies contribute to meeting the critical needs of Kenyan farmers and retailers by providing predictive insights into future commodity prices?

# Objectives

- To identify key patterns and trends and relationships in the data
- Develop a predictive robust timeseries model that predicts the future prices of key agricultural commodities in Kenya
- Create a Market Basket Analysis for Retailers
- To deploy a crop pricing model.
- To provide recommendations on the outcomes of the project to our stakeholders

# Stakeholders

Kenyan Farmers

Retailers specializing in Cash crops

# Data Understanding

## Main dataset

Contains Food Prices data for Kenya, sourced from the World Food Programme Price Database.

## Additional datasets

Other external datasets were merged into our main dataset for better prediction. This includes Inflation rates sourced from the Central Bank of Kenya and weather patterns data.

# Data preparation

Merged the 3 datasets

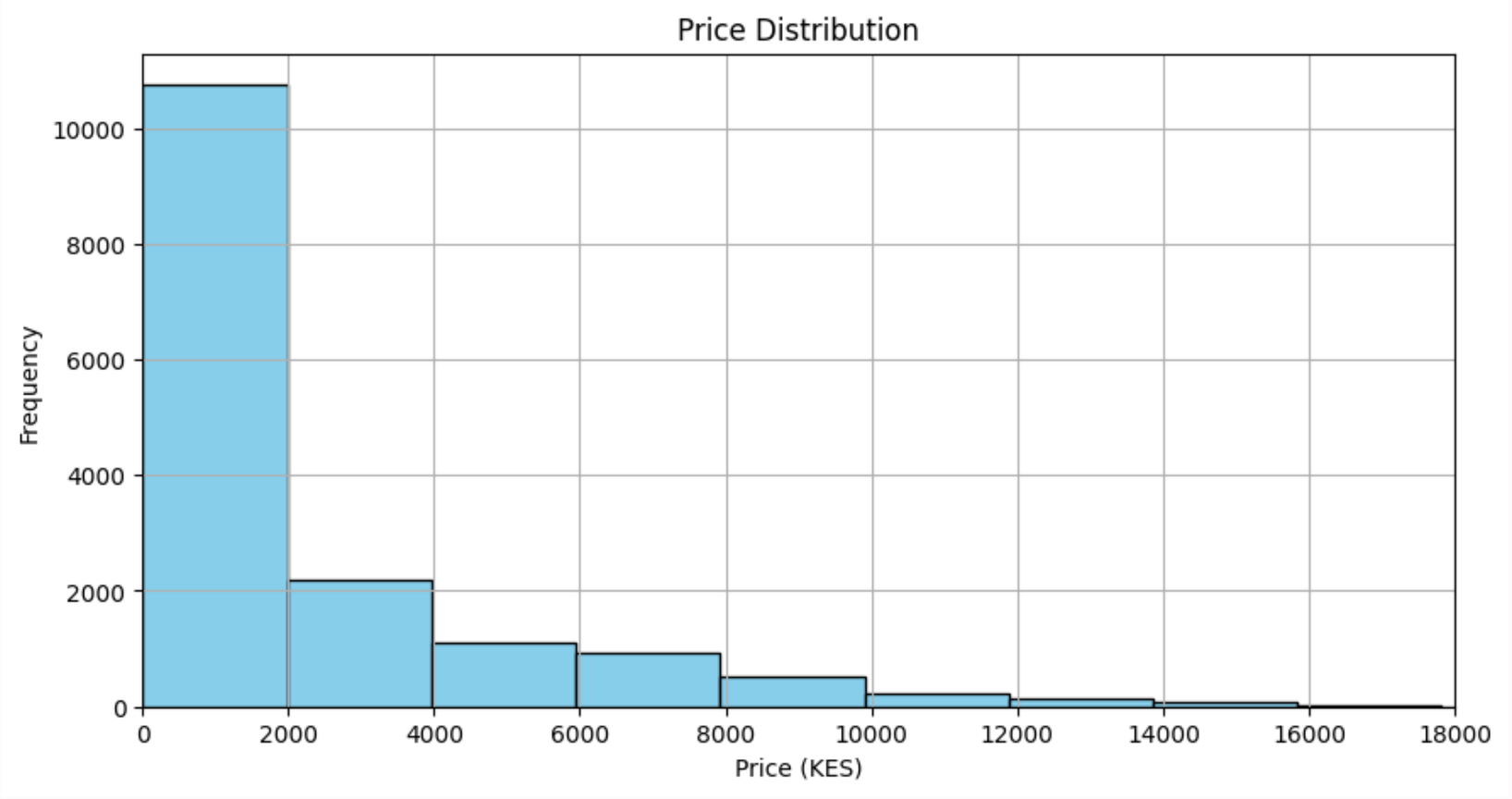
Renamed columns to represent the data correctly

Unnecessary columns were dropped

Handling Missing values

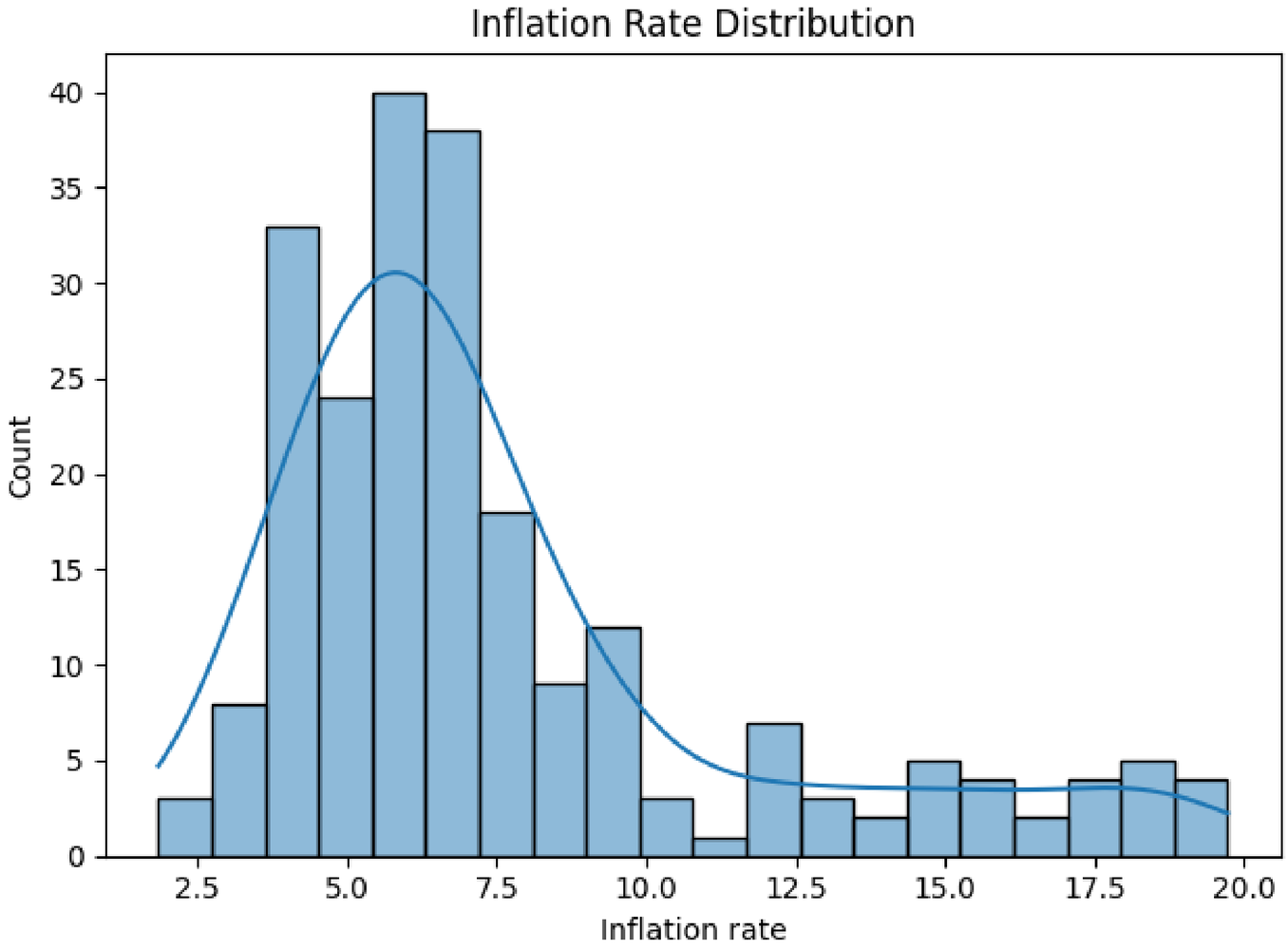
# EXPLORATORY DATA ANALYSIS (EDA)

UNIVARIATE ANALYSIS >>>> BIVARIATE ANALYSIS >>>> MULTIVARIATE ANALYSIS



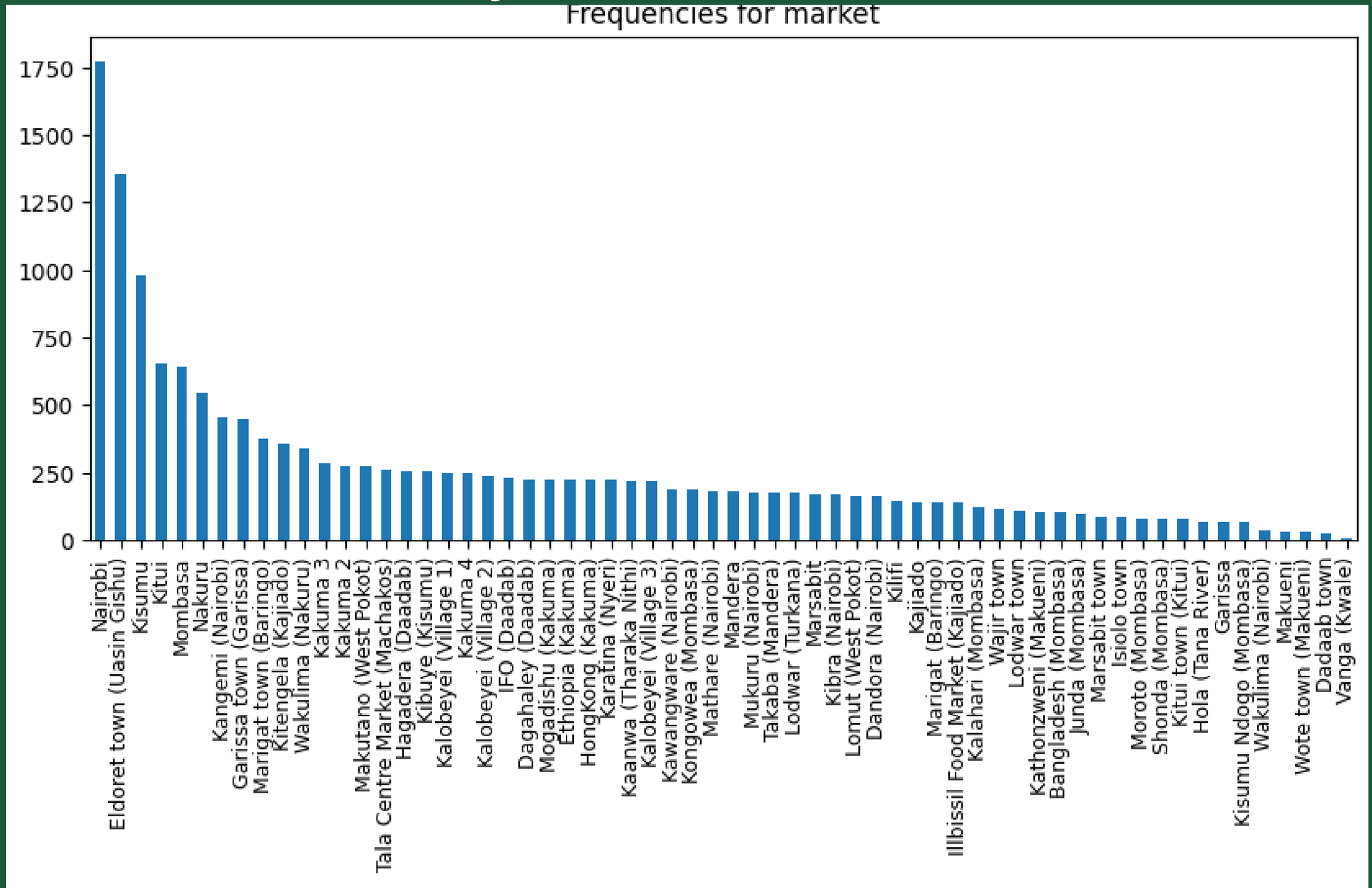

COMMODITY PRICES VARY FROM AS LOW AS 5 TO AS HIGH AS 19,800.

The inflation rate varies from a minimum of 1.85% to a maximum of 19.72%, with an average inflation rate of approximately 7.0%.

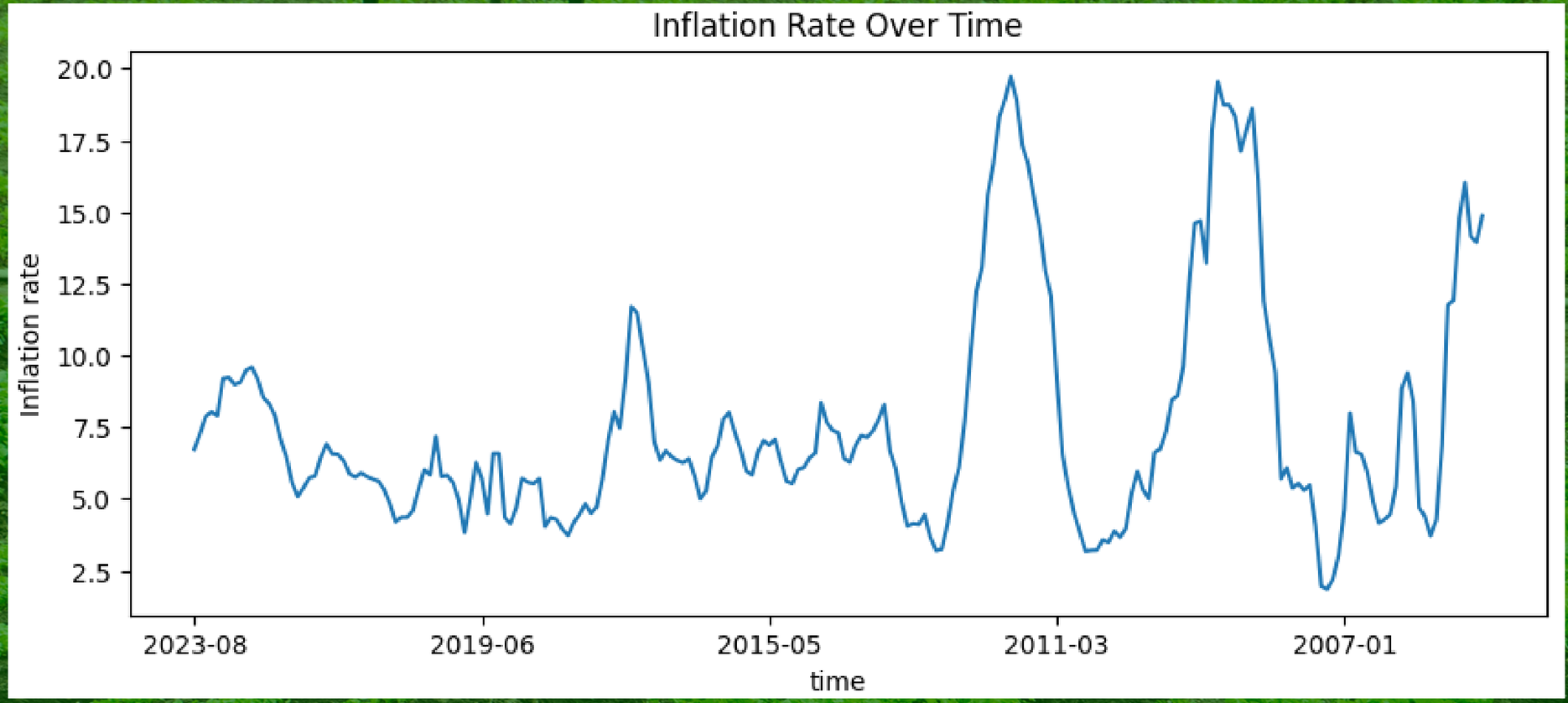


# Market Analysis

Most of the markets surveyed were located in Nairobi followed by Eldoret town and then Kisumu.

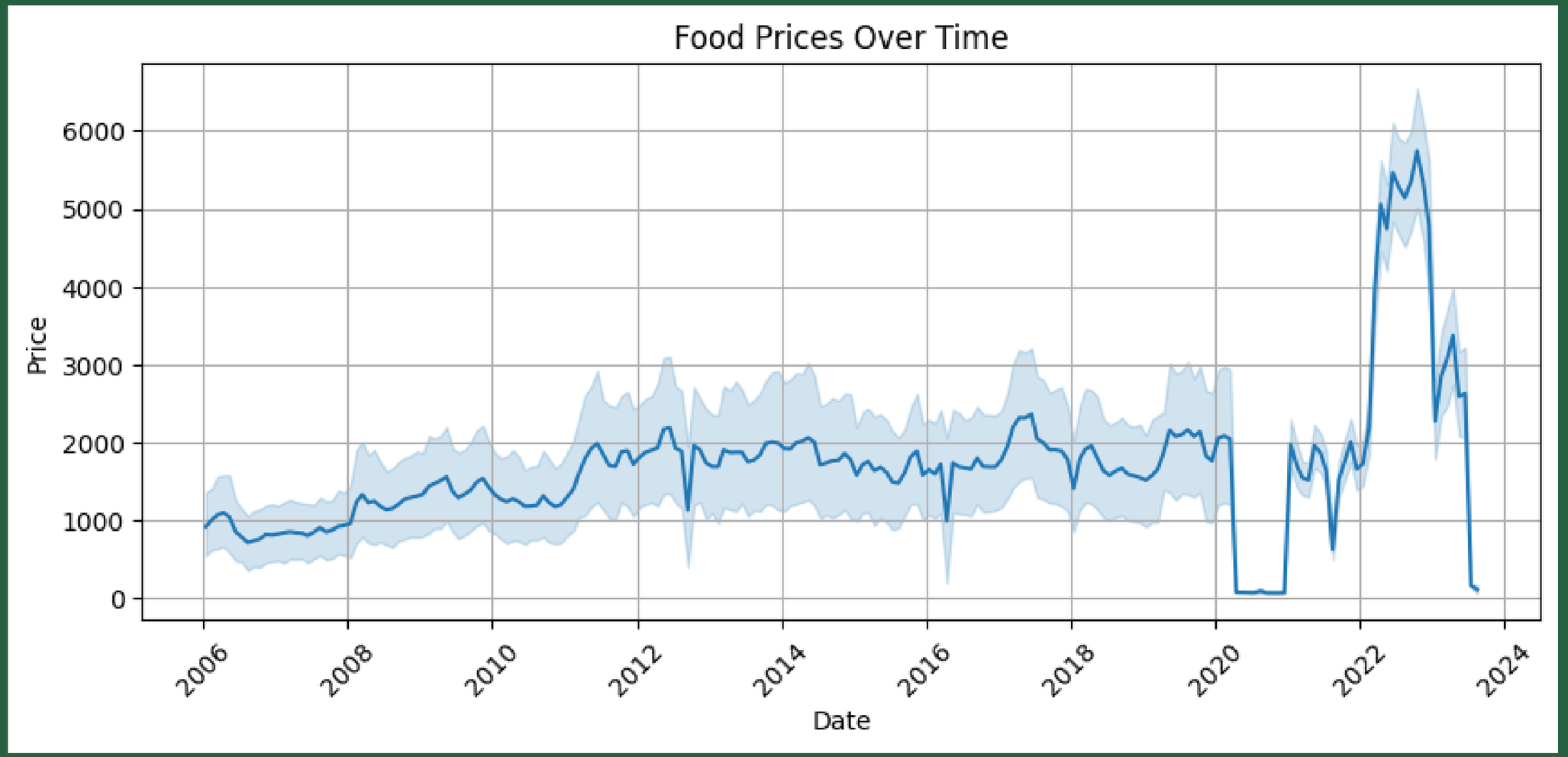


# Bivariate Analysis
## Inflation Rate Trends



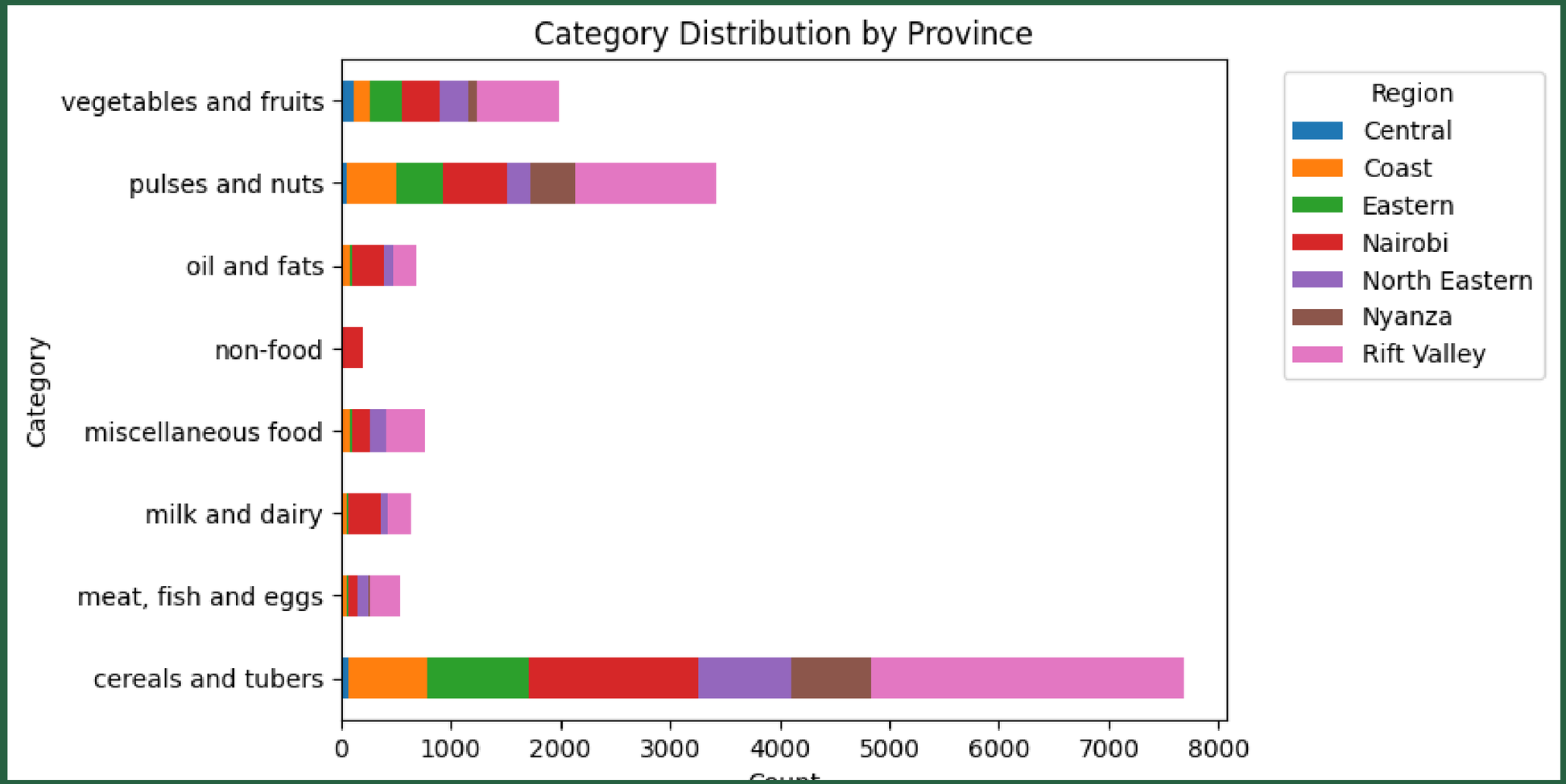

Inflation rates appear to have stabilized between 2013 to date, compared to the years prior, which illustrated large differences between the highest and lowest inflation rates. As a result, inflation rates are more predictable in recent years compared to the earlier years.

# Food Prices Trend



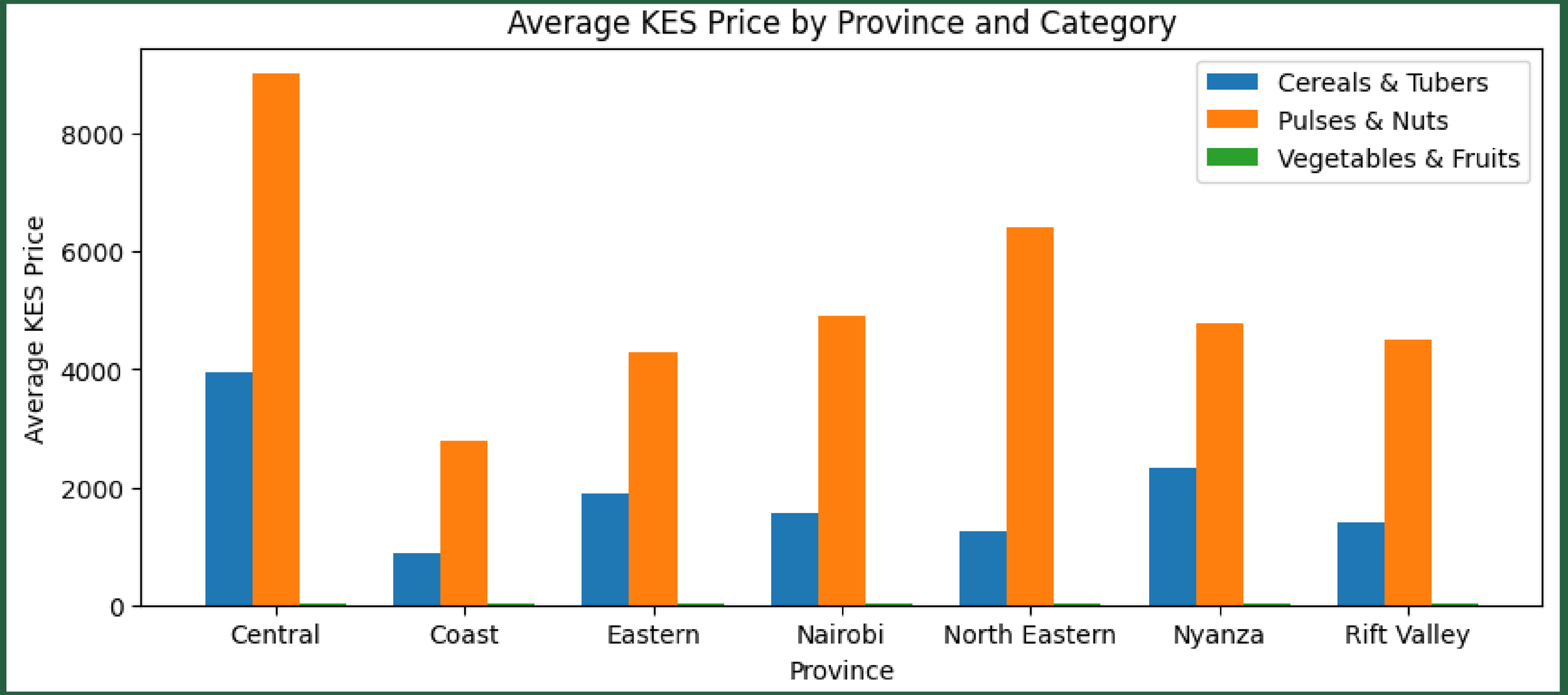

There has been a general increase in prices of food commodities over the years except for the gaps noted in 2020/2021 which can be attributed to missing data, data discontinuity, and/or data entry errors in the dataset.

# Popular Food Commodities




The food categories "cereals and tubers" are prevalent across a wide range of provinces, including Rift Valley, Nyanza, North Eastern, Nairobi, Eastern, Coast, and Central.

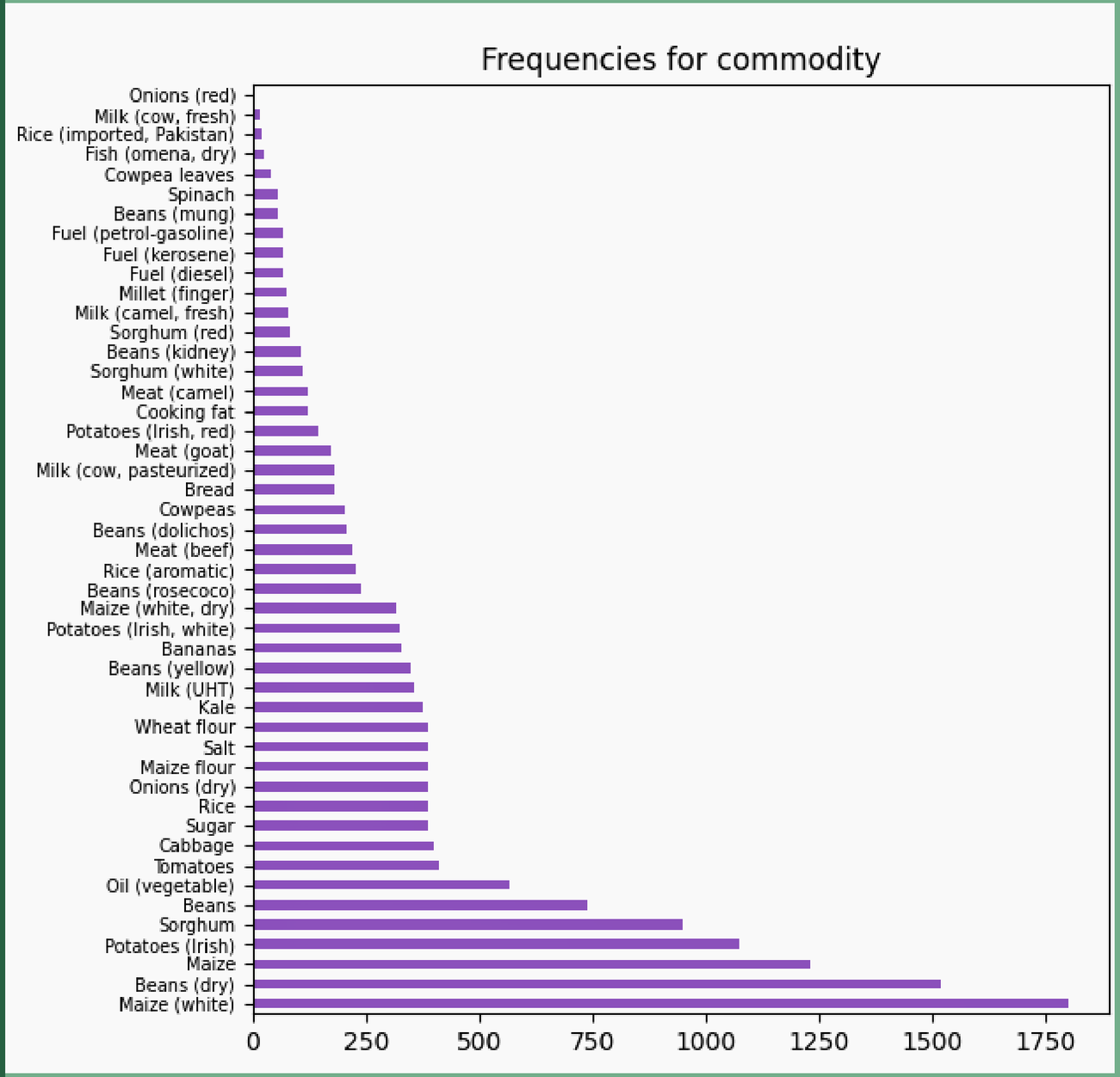
# Average Price By Province and Food Category




"Pulses and Nuts" tend to have higher prices compared to the other food categories across different regions.

# Top food commodities

Based on this chart we chose to use only maize and beans in our models as they were the most frequent.



# MODELLING

## Two models for this project

### 1. SARIMA

We used the SARIMA MODEL due to the presence of seasonality in the data. Mean absolute error (MAE), and  mean square error(MSE) were used to measure the performance of the model

### 2.LSTM

The LSTM model, which is a Recurrent Neural Network suitable for time series data, was also used for forecasting.
Mean absolute error (MAE),  Root Mean Square Error(RMSE), Mean Square Error(MSE) and R-squared (R2) metrics were used to measure the performance of the model

# MODEL EVALUATION FOR MAIZE

| | SARIMA | LSTM |
|---|---|---|
| RMSE | 12.17 | 9.40 |
| MSE | 148.20 | 88.49 |
| MAE | 9.30 | 6.42 |
| R-Squared | 0.51 | 0.57 |

# MODEL EVALUATION FOR BEANS

| | SARIMA | LSTM |
|---|---|---|
| RMSE | 24.36 | 7.75 |
| MSE | 593.48 | 60.07 |
| MAE | 17.75 | 5.49 |
| R-Squared | 0.22 | 0.71 |

# Conclusions

**Price Variability**: Our study revealed significant price fluctuations in the market, indicating that food prices in Kenya can vary substantially over time. This finding underscores the importance of understanding and predicting these price fluctuations to assist both farmers and consumers in making informed decisions.

**Inflation Rate Connection**: Our analysis identified a correlation between the inflation rate and the prices of food items. This connection suggests that changes in the general price level in the economy have an impact on food prices. Understanding this relationship can be crucial for policymakers and market participants in managing food inflation and ensuring affordability for consumers.

**Food Category Preferences**: Our research uncovered distinct preferences among Kenyan consumers for specific food categories. Recognizing these preferences is valuable for market decision-makers, as it can guide product positioning, marketing strategies, and the supply of preferred food items. This insight into consumer behavior can inform more effective market planning and product offerings.

# Recommendations

Farmers and Retailers should use price forecasts for planning crop strategies.

Diversifying crop portfolios can help farmers reduce market vulnerability.

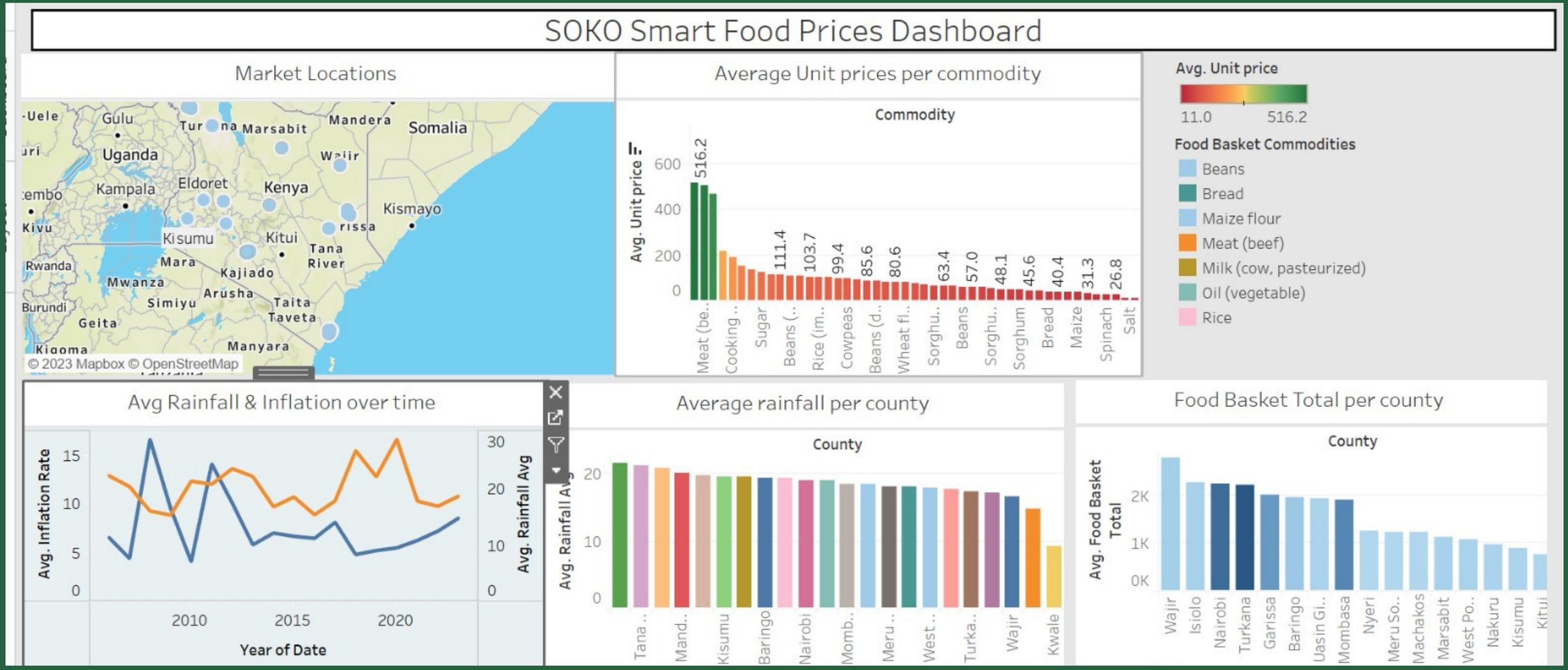
Retailers can explore hedging strategies to manage price risks.

Government and Policymakers should incorporate price forecasts into food security and agricultural policies.

To manage rising prices, the government should secure more food commodities.

Consumers should be mindful of price fluctuations to manage their food budget effectively.

# TABLEAU


SOKO Smart Food Prices Dashboard
Market Locations
Uganda
Kampala
Eldoret
Kenya
Somalia
Kismayo
Kisumu
Kitui
Tana River
Mara
Kajiado
Mwanza
Arusha
Simiyu
Taita Taveta
Geita
Manyara
Rwanda
Burundi
Kigoma
Marsabit
Mandera
Wajir
Kivu
Gulu
© 2023 Mapbox © OpenStreetMap
Average Unit prices per commodity
Commodity
Avg. Unit price
516.2
111.4
103.7
99.4
85.6
80.6
63.4
57.0
48.1
45.6
40.4
31.3
26.8
Meat (be..
Cooking ..
Sugar
Beans (..
Rice (im..
Cowpeas
Beans (d..
Wheat fl..
Sorghu..
Beans
Sorghu..
Sorghum
Bread
Maize
Spinach
Salt
Avg. Unit price
11.0
516.2
Food Basket Commodities
Beans
Bread
Maize flour
Meat (beef)
Milk (cow, pasteurized)
Oil (vegetable)
Rice
Avg Rainfall & Inflation over time
Avg. Inflation Rate
Avg. Rainfall Avg
Year of Date
2010
2015
2020
Average rainfall per county
County
Avg. Rainfall Avg
Tana ..
Mand..
Kisumu
Baringo
Nairobi
Momb..
Meru ..
West..
Turka..
Wajir
Kwale
Food Basket Total per county
County
Avg. Food Basket Total
Wajir
Isiolo
Nairobi
Turkana
Garissa
Baringo
Uasin Gi..
Mombasa
Nyeri
Meru So..
Machakos
Marsabit
West Po..
Nakuru
Kisumu
Kitui


Thank you!
Any Questions ?