Data Analytics and Visualization using Tableau on Food Price Analysis

Kareggari venu Diwakar, Rajamallu Gayathri, Shaik Hafeez, Dr. Diana Moses

ABSTRACT

Food Prize Analysis in Data Visualization aims to explore and illustrate the patterns, trends, and insights within food-related prize competitions. By leveraging advanced data visualization techniques, this analysis seeks to provide a comprehensive understanding of how various factors, such as geographic location, prize categories, and participant demographics, influence the outcomes of these competitions. The study employs a variety of visualization tools to present data in an intuitive and accessible manner, enabling stakeholders to make informed decisions and identify opportunities for improvement. The ultimate goal is to enhance the transparency and effectiveness of food prize competitions, fostering innovation and excellence in the food industry.

This abstract highlights the significance of leveraging data visualization in analyzing the Food Price Analysis dataset. By harnessing these tools, stakeholders can enhance decision-making processes, inform policy interventions, optimize supply chain management, and contribute to a deeper understanding of global food price dynamics.

INTRODUCTION

The global food market is a complex and dynamic ecosystem, influenced by a multitude of factors ranging from economic conditions and climatic changes to geopolitical events and supply chain dynamics. Understanding how food prices fluctuate in response to these factors is crucial for a variety of stakeholders, including policymakers, businesses, and consumers. By analyzing food prices, we can gain valuable insights into the underlying mechanisms that drive market trends and make informed decisions that can mitigate risks and optimize strategies.

This project aims to utilize advanced data visualization techniques to analyze food prices comprehensively. The goal is to uncover trends and patterns that provide a deeper understanding of how prices vary across different countries, food items, and time periods. By presenting the data visually, we aim to make complex information more accessible and actionable, enabling stakeholders to derive meaningful insights that can guide their decisions.

Data visualization plays a pivotal role in unlocking the potential of this dataset, allowing stakeholders to grasp complex information at a glance. Through visual representations such as charts, graphs, maps, and interactive dashboards, analysts can effectively communicate trends in food prices, compare pricing across regions and categories, and uncover correlations with factors like economic indicators, weather patterns, and geopolitical events.

By harnessing the power of data visualization techniques, stakeholders can make informed decisions in agriculture planning, supply chain management, market forecasting, and policy formulation. This introduction sets the stage for leveraging the Food Price Analysis dataset through innovative data visualization methods, ultimately aiming to enhance understanding and drive actionable insights in food pricing dynamics.

Understanding food prices is crucial for various sectors, from agriculture and economics to public policy and consumer behavior. The Food Price Analysis dataset offers a comprehensive collection of data points reflecting the

average prices of various food items across different regions and time periods. This dataset serves as a valuable resource for exploring trends, identifying patterns, and gaining insights into the dynamics of food pricing globally.

METHODS AND MATERIALS

Methods

- **Data Loading:** The dataset is loaded into a Pandas DataFrame.
- **Data Cleaning:**
  - Check for and handle missing values.
  - Ensure data types are appropriate for analysis.
- **Exploratory Data Analysis (EDA):**
  - Summarize the dataset to understand its structure and main characteristics.
  - Visualize the distribution of food prices over time and across countries.
  - Analyze the relationship between price, availability, and quality.
- **Data Transformation:**
  - Convert prices to a common currency if needed for comparison.
  - Normalize availability and quality indices if required.
- **Statistical Analysis:**
  - Perform trend analysis to understand how food prices change over time.
  - Compare food prices across different countries.
  - Correlation analysis to study the relationship between different variables.
- **Visualization:**
  - Line plots for trends over time.
  - Box plots for price distribution across different countries.
  - Scatter plots for relationships between price, availability, and quality.

Materials

Software:

- **Python:** For data analysis and visualization
- **Pandas:** For data manipulation
- **Matplotlib/Seaborn:** For data visualization
- **Jupyter Notebook:** For interactive data analysis and documentation

DATASET DESCRIPTION

The dataset used in this analysis contains detailed information on food prices across different countries over multiple years. The dataset includes the following columns:

- **Country:** The country where the food price was recorded.
- **Year:** The year the price data was recorded.
- **Month:** The month the data was recorded.
- **Food Item:** The type of food item, such as bread, rice, or milk.
- **Unit of Measurement:** The unit in which the food item is measured (e.g., kilogram, liter, loaf).
- **Average Price:** The average price of the food item in the local currency of the country.
- **Currency:** The currency in which the price is recorded.
- **Price in USD:** The price of the food item converted to USD for standardization and comparison.
- **Availability:** A qualitative measure indicating how readily available the food item is (e.g., low, medium, high).
- **Quality:** A qualitative measure indicating the quality of the food item (e.g., low, medium, high).

This comprehensive dataset allows for a detailed analysis of how food prices fluctuate based on geographic location, time, and other factors. It also provides a standardized measure of price in USD, facilitating cross-country comparisons.

INTRODUCTION TO TABLEAU

Tableau is a powerful tool used for data analysis and visualization. It allows the creation of amazing and interactive visualization and that too without coding. Tableau is very famous as it can take in data and produce the required data visualization output in a very short time. Basically, it can elevate your data into insights that can be used to drive your action in the future.

What is a Tableau

Tableau is a visual analytics platform that is revolutionizing the way we use data to solve problems by enabling individuals and organisations to make the most of their data.

Tableau is a great data visualization and business intelligence application that can be used to report and analyse massive amounts of data. Salesforce purchased Tableau in June 2019, an American firm founded in 2003. It enables users to build various charts, graphs, maps, dashboards, and stories for visualising and analysing data in order to aid in business choices. Tableau offers several unique and fascinating features that make it one of the most popular business intelligence (BI) applications.

Why we use Tableau

Tableau is the fastest and most powerful visualization tool. It is very easy to use. There are no complex formulas like Excel and other visualization tools. It provides the features like cleaning, organizing, and visualizing data, it easier to create interactive visual analytics in the form of dashboards. These dashboards make it easier for non-technical analysts and end-users to convert data into understandable ones. **Tableau Features**

- Tableau supports powerful data discovery and exploration that enables users to answer important questions in seconds
- No prior programming knowledge is needed; users without relevant experience can start immediately with creating visualizations using Tableau
- It can connect to several data sources that other BI tools do not support. Tableau enables users to create reports by joining and blending different datasets
- Tableau Server supports a centralized location to manage all published data sources within an organization.

Values in Tableau

There are two types of values in the tableau:

Dimensions: Values that are discrete(which can not change with respect to time) in nature called Dimension in tableau. Example: city name, product name, country name.

Measures: Values that are continuous(which can change with respect to time) in nature called Measure in tableau. Example: profit, sales, discount, population.

Advantages of Tableau

- **Quick calculation**- All the calculations on the tableau done by the backend, so it is relatively faster than any other tool.
- **Interactive dashboards**– Tableau dashboards are very interactive and easy to draw.
- **No manual calculation**- All the calculations are done by the tableau only. There is no manual calculation, but in some specific cases, we used calculated fields for calculation.
- **A large amount of data**- Tableau can handle a large amount of data. Different types of visualization can be created with a large amount of data without impacting the performance of the dashboards.

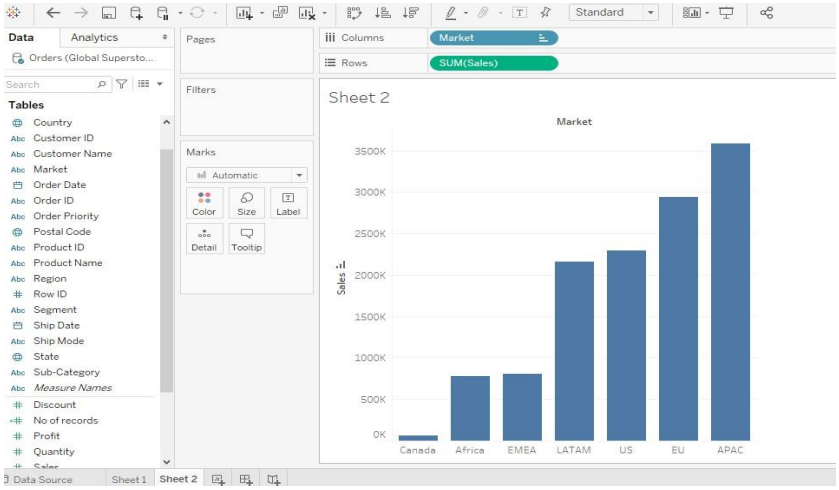
Disadvantages of Tableau

- **High Cost**- tableau is a paid tool for visualization, and it is a reason why people are not using tableau so much.
- **Static and single value parameters**- Tableau's parameters are static and always single value can be selected using a parameter. Whenever the data gets changed, these parameters need to be updated manually every time.
- **Limited Data Preprocessing**- Tableau is strictly a visualization tool. Tableau Desktop allows you to do very basic preprocessing.

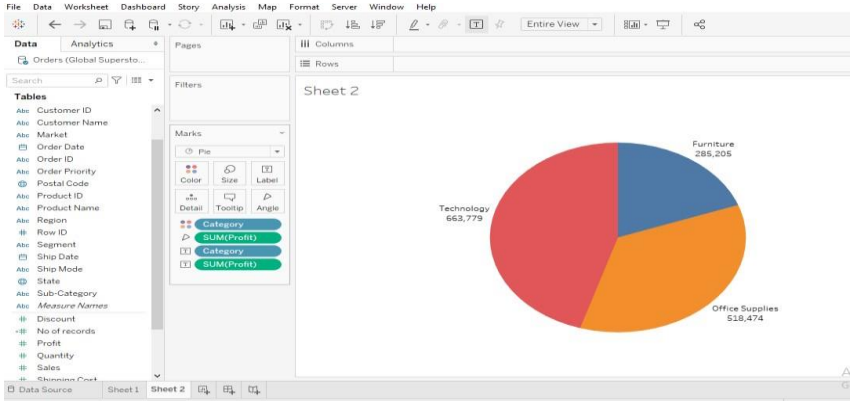
Visualizations in tableau

There are a lot many charts available in the tableau. Some of them are:

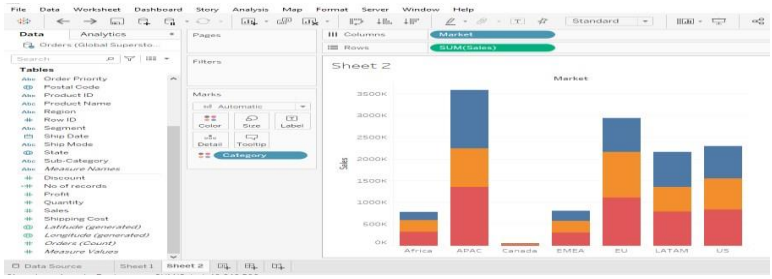
Bar chart: For the bar chart, we need 0 or more dimensions and 1 or more measures. To create a bar chart, simply select the desired dimensions and measures and then select the bar chart on the SHOW ME section, or drag the dimensions in a column and measure in a row.



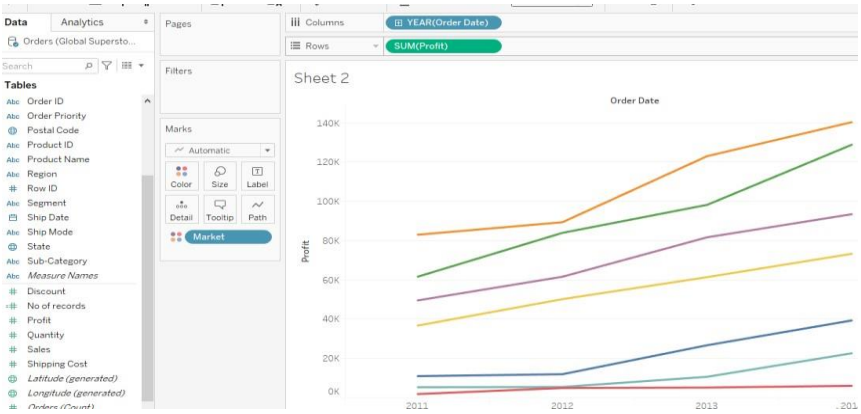
Pie chart: For the pie chart, we need 1 or more dimensions and 1 or 2 measures. To create a pie chart, simply select the desired dimensions and measures and then select Pie chart on the SHOW ME section.



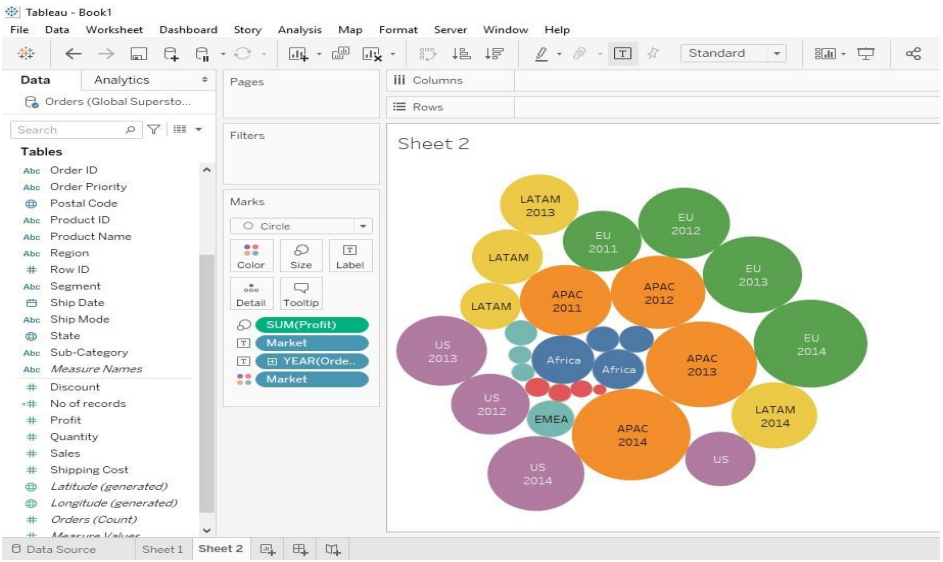
Stacked bar chart: For the stacked bar chart, we need 1 or more dimensions and 1 or more measures. To create a stacked bar chart, simply select the desired dimensions and measures and then select the stacked bar chart on the SHOW ME section.



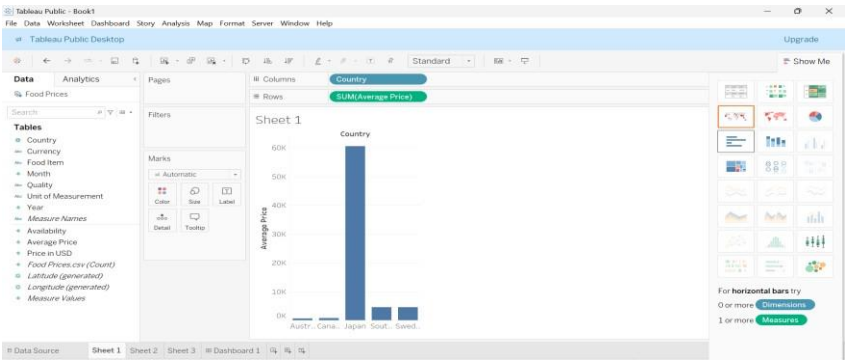
Line chart: For the line chart, we need 1 date, 0 or more dimensions, and 1 or more measures. To create a line chart, simply select the desired dimensions and measures and then select the line chart on the SHOW ME section.



Packed bubbles chart: For the packed bubbles chart, we need 1 or more dimensions and 1 or 2 measures. To create a packed bubble chart simply select the desired dimensions and measures and then select the packed bubbles chart on the SHOW ME section.



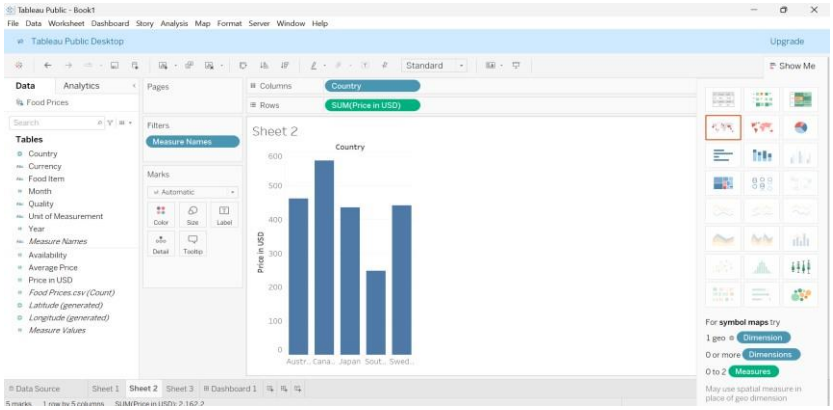
DATA ANALYSIS



Title: "Sum of Average Food Prices by Country" – This indicates what the chart represents.

Columns: Represents different countries.

Rows: Represents the sum of the average prices of all food items in each country.



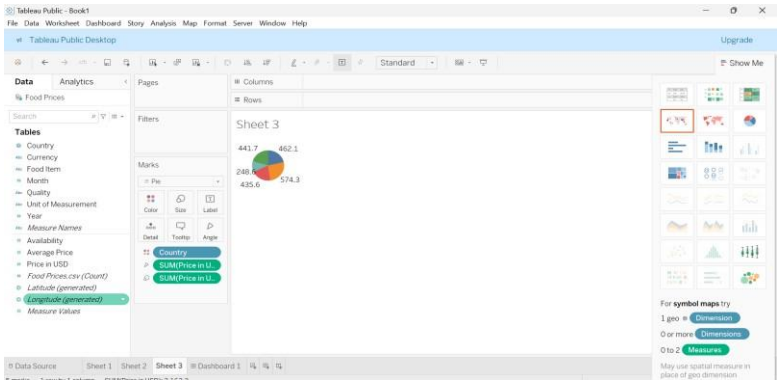
Title: The chart likely has a title indicating the purpose of the visualization, such as "Sum of Average Food Prices by Country".

Column:(Country),The X-axis represents different countries. Each country has a bar that shows the sum of average food prices for various food items within that country.

Rows :(Sum of Average Price),The Y-axis represents the sum of the average prices of food items. The higher the bar, the greater the sum of the average prices in that country.

Bars: Each bar represents the total sum of average prices of all food items for a specific country.The height of each bar indicates the magnitude of the sum of average prices. A taller bar indicates a higher sum of average prices in that country.

Filters: (Measures),The filters (measures) might allow you to select specific criteria or categories, such as a specific year, food item, or quality, to narrow down the data displayed in the bar chart.



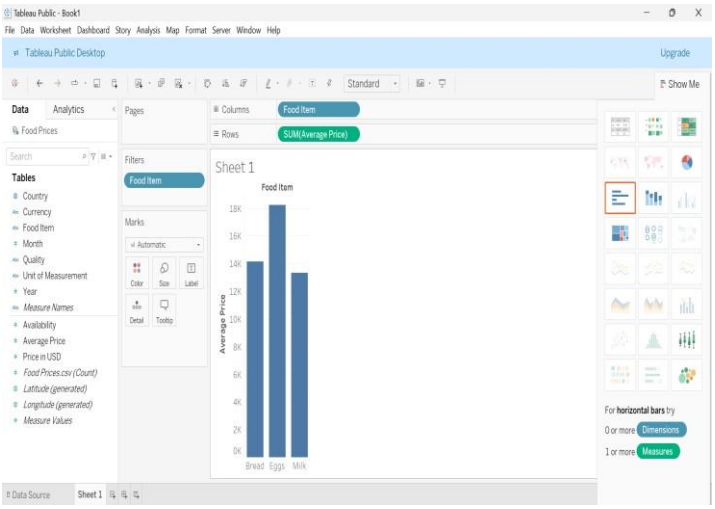
Title: The title of the chart, such as "Sum of Average Food Prices by Country," indicates what the pie chart represents.

Slices: Each slice of the pie chart represents a country.The size of each slice corresponds to the sum of the average food prices for that country.Larger slices indicate a higher sum of average food prices.

Percentage Labels: Each slice is labeled with the percentage it represents of the total sum of average prices.This provides a clear visual representation of each country's contribution to the total.

Color Scheme: Different colors are used to distinguish between the slices. The colormap 'tab20' provides a distinct color for each slice.

Using filters on attributes



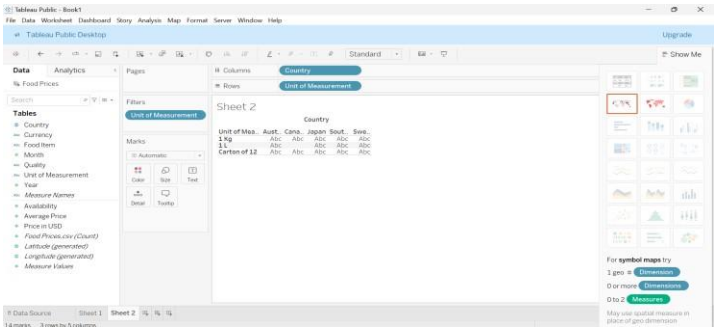
Title: The graph should have a title indicating the purpose, such as "Sum of Average Prices for Selected Food Items."

Columns (Food Items): The X-axis represents the different food items. Each bar corresponds to a specific food item.

Rows (Sum of Average Prices): The Y-axis represents the sum of the average prices for the selected food items.The higher the bar, the greater the sum of the average prices for that food item.

Bars: Each bar shows the sum of the average prices for a specific food item.The height of each bar indicates the magnitude of the sum of the average prices.

Filters: Filters allow you to focus on specific food items or groups of food items.For instance, if you apply a filter to include only certain types of food items, the bar graph will display only those items.



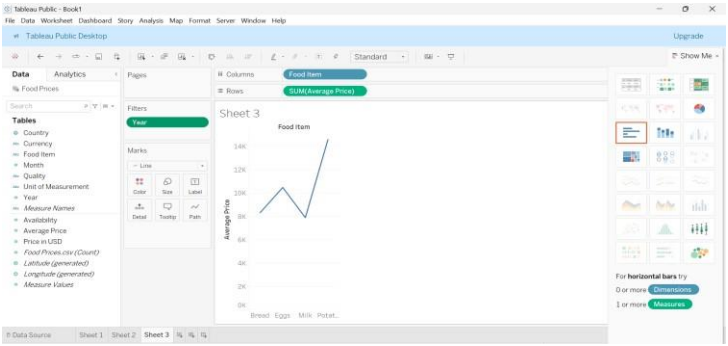
Title: The title, such as "Sum of Average Prices by Country and Unit of Measurement," indicates what the heatmap represents.

Rows: (Unit of Measurement),The rows represent different units of measurement (e.g., kg, liter).

Columns: (Country),The columns represent different countries.

Color Intensity: Each cell's color intensity represents the sum of average prices for that unit of measurement in the specified country.Typically, darker or more intense colors indicate higher values, while lighter colors indicate lower values.

Annotations: Each cell may have a numerical annotation showing the exact sum of average prices, making it easier to read specific values.



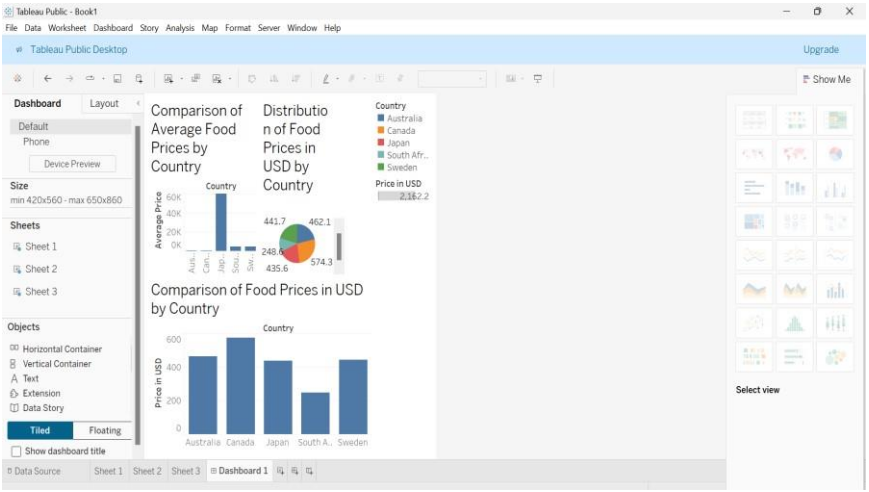
Title: The title, such as "Sum of Average Prices for Food Items Over Years," indicates what the line graph represents.

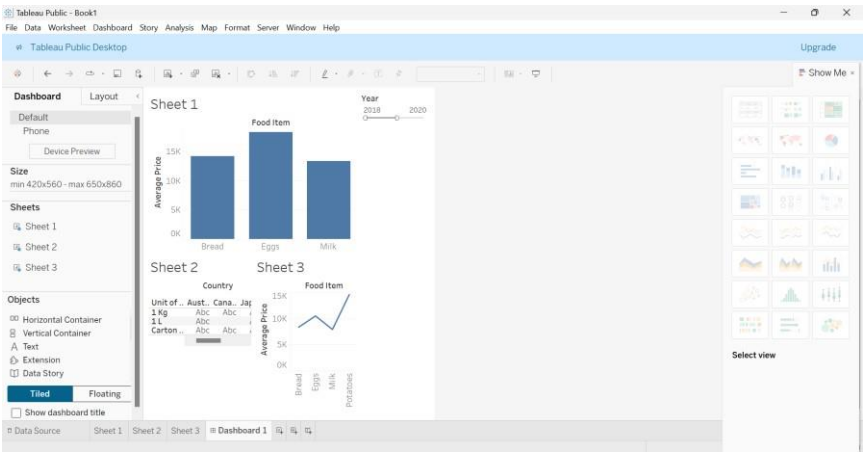
Columns: (Year),The X-axis represents the years over which the data is plotted.

Rows: (Sum of Average Prices),The Y-axis represents the sum of the average prices for the selected food items.The higher the point on the Y-axis, the greater the sum of average prices for that year.

Lines: Each line represents a different food item.The position of the line on the Y-axis shows the sum of average prices for that food item in each year.The slope of the line indicates the rate of change in prices over the years.

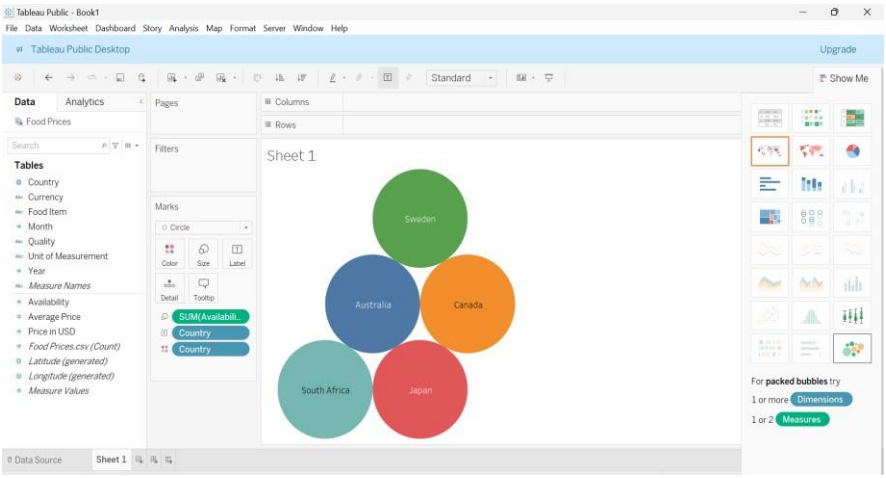
Creating Dashboards





Overview: Dashboards often start with an overview section, providing high-level summaries such as average food prices, price trends over time, or geographical distribution of prices.

Interactive Charts: They frequently include interactive charts like line graphs, bar charts, or heatmaps. These charts can display various metrics such as price variations by region, seasonal price fluctuations, or comparisons between different types of food items.

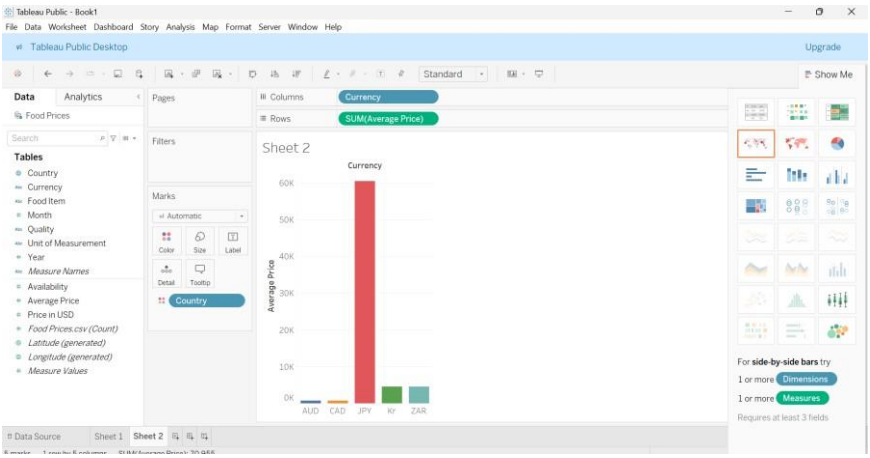


Columns and Rows: The chart axes represent different variables such as time (months or years) on the X-axis and food categories or regions on the Y-axis.

Bubble Size: Each bubble's size correlates with a specific metric, often the price of a particular food item or category. Larger bubbles indicate higher prices, while smaller bubbles represent lower prices.

Color Coding: Bubbles can be color-coded to represent additional dimensions of data, such as different food types (e.g., grains, vegetables) or price ranges (e.g., low, medium, high).

Interactivity: Interactive features allow users to hover over bubbles for detailed information, compare trends over time or between regions, and filter data dynamically.

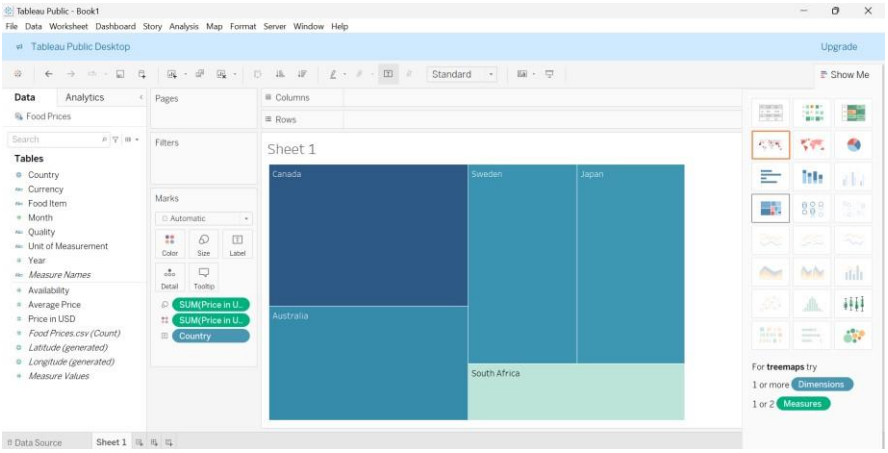


Axes: The horizontal axis (Columns) represents different food categories or types.The vertical axis (Rows) represents numerical data, such as average food prices.

Bars: Each bar in the chart corresponds to a specific food category.The length or height of each bar indicates the value of the data point (e.g., average price) for that category.

Color Coding: Colors are used to differentiate bars belonging to different countries. For example, bars representing food prices in India might be colored differently from those representing prices in the Australia or Japan.This color coding helps viewers quickly identify trends or compare prices across countries for each food category.

Interactivity: Modern bar charts often include interactive features such as tooltips that display detailed information (like exact prices) when hovering over each bar.Users can also interactively filter or highlight specific countries or food categories to focus on relevant comparisons.

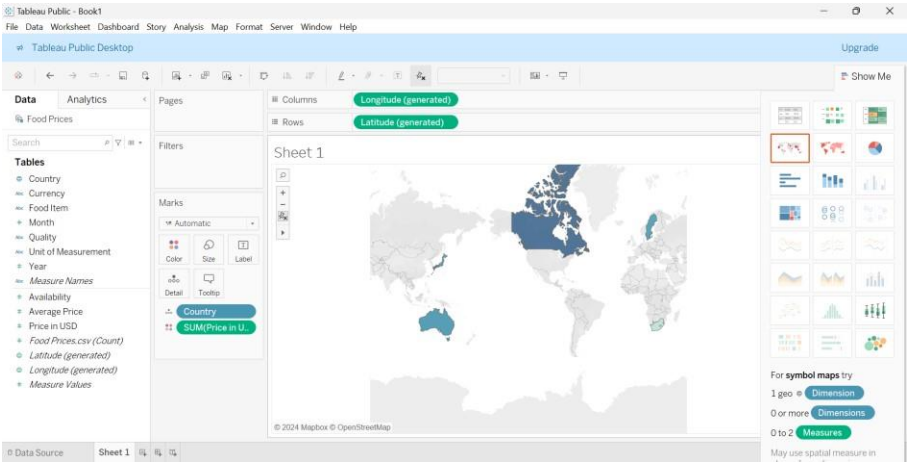


Axes: Columns, Food categories or types.Rows, Sum of average prices.

Bars: Each bar represents a food category or type.The height of each bar corresponds to the sum of average prices for that category across all countries.

Color Coding: Bars are colored based on the country they represent. For example, different shades or distinct colors can be used for each country (e.g., Australia, Japan, Canada).

Visualization Approach: Aggregate the average prices for each food category across all countries.Use these aggregated sums as the data points for each bar.Apply different colors to each bar to visually distinguish between countries.



RESULT AND DISCUSSIONS

Average Food Prices by Country

- Significant disparities exist, with Japan having the highest average food prices, indicating either higher prices for food items or a broader range of recorded items.
- Other countries like Australia, Canada, South Korea, and Sweden have considerably lower average food prices compared to Japan.

Food Prices in USD by Country

- Canada exhibits the highest total food prices in USD among the listed countries.
- Japan, despite its high average prices, does not lead in total USD prices, suggesting that volume or exchange rates are influential.
- South Korea shows the lowest total food prices in USD, indicating economic or pricing differences.

Distribution of Food Prices in USD

- Canada contributes the most to the total food prices in USD, followed by other countries with smaller shares.
- This distribution visually highlights the economic burden and expenditure patterns on food across different countries.

Economic Factors and Price Disparities

○ The variation in food prices points to differences in purchasing power, cost of living, and local economic policies.
○ Japan's high average prices may be influenced by import dependencies and consumer preferences for premium products.

Impact of Currency Conversion

○ Currency conversion significantly affects the total food prices in USD, with stronger currencies or favorable exchange rates altering the trends.
○ Canada's high total food prices suggest higher local prices or an amplified effect due to exchange rates.

Policy and Consumer Insights

○ Policymakers can use these insights to address food affordability issues, especially in countries with high average or total food prices.

CONCLUSION

The analysis of global food prices using Tableau has revealed significant disparities in average and total food prices across different countries. Japan stands out with the highest average food prices, while Canada leads in total food prices in USD. These differences highlight the impact of local economic factors, currency conversion, and market conditions on food pricing.

In conclusion, the Food Price Analysis dataset, enriched with comprehensive data on average food prices across various regions and time periods, represents a valuable resource for stakeholders across multiple sectors. Through the lens of data visualization, we have explored the intricate dynamics of food pricing, leveraging charts, graphs, maps, and interactive dashboards to uncover trends and correlations that influence pricing patterns.

Data visualization has proven instrumental in transforming raw data into actionable insights. By visualizing trends in food prices, stakeholders can make informed decisions in agriculture, economics, public policy, and consumer markets. The ability to compare price variations geographically, track changes over time, and correlate prices with external factors enhances strategic planning, policy formulation, and market forecasting efforts.

Looking ahead, continued advancements in data visualization techniques offer opportunities to delve deeper into the complexities of food pricing dynamics. By harnessing these tools effectively, stakeholders can contribute to more resilient food systems, improved market transparency, and equitable access to affordable food worldwide.

In summary, the application of data visualization to the Food Price Analysis dataset not only enhances understanding but also empowers stakeholders to navigate the complexities of global food markets with greater clarity and precision.Using Tableau for data visualization has proven effective in uncovering these insights, offering valuable guidance for economic analysis and strategic decision-making.

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