Topic:

Trend Analysis on Meat Animals Import and Export Quantities and Values

Zemelak Goraga

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Introduction

The meat animals import and export business is a critical aspect of global trade, impacting both the agricultural sector and the economy of nations. Understanding the trends in import and export quantities and values of meat animals, such as cattle, chicken, sheep, and pigs, provides valuable insights for policymakers, agricultural stakeholders, and investors. This analysis aims to uncover patterns, and contribute to informed decision-making in the context of the meat animals trade. As a data science problem, the challenge lies in handling large-scale, historical datasets to extract meaningful trends, patterns, and correlations that can guide strategic decisions.

In this data science project, the aim is to conduct a comprehensive analysis of this domain using four datasets (A, B, C, D: please refer methodology section) obtained from the FAOSTAT historical dataset available on Kaggle.

Research Questions

The primary focus of this analysis is on trend analysis concerning meat animals' import and export quantities and values. I am interested in understanding how these trends have evolved over the years and identifying patterns across different countries and animal types. The research questions aim to uncover insights into the dynamics of the global meat animals market and inform strategic decision-making. The research questions are formulated based on these 4 datasets:

Dataset A: 'export_&_import_quantities'

Dataset B: 'export_quantities_&_values'

Dataset C: 'import_quantities_&_values'

Dataset D: 'export_&_import_values'

These datasets were obtained from the FAOSTAT historical dataset on Kaggle (Source: https://www.kaggle.com/datasets/unitednations/global-food-agriculture-statistics).

Research Questions by dataset:

For Dataset A (export quantities and import quantities):

1. What is the trend in the import quantities of cattle from the top 10 countries over the past 10 years?

2. What is the trend in the export quantities of cattle from the top 10 countries over the past 10 years?

For Dataset B (export quantities and export values):

3. How has the export quantity of sheep from Australia evolved over the years?

4. Is there a correlation between the export quantity and export value of sheep in Australia?

For Dataset C (import quantities and import values):

5. How has the import quantity of chicken from Europe evolved over the years?

6. How does the import quantity of chicken in Europe correlate with the corresponding import values?

For Dataset D (export values and import values):

7. What is the overall trend in the import and export values of pigs from the top 10 countries over the past 10 years?

8. Are there notable changes in the import and export values of pigs in Europe over the past 10 years?

Approach:

To address the problem statements of trend analysis on meat animals' import and export quantities and values, the approach involves a comprehensive data science pipeline. This includes data cleaning, exploration, and visualization, followed by the formulation and answering of research questions. The primary goal is to uncover patterns, correlations, and trends in the datasets (A, B, C, D) to inform decision-making in the meat animals trade.

The proposed approach involves the following steps:

Data Cleaning and Wrangling: The datasets are cleaned to handle missing values, remove duplicates, and ensure data integrity. This step ensures that the subsequent analysis is based on reliable data.

Exploratory Data Analysis (EDA): EDA is conducted to understand the distributions, relationships, and summary statistics of the variables in the datasets. This helps in identifying patterns and potential outliers.

Trend Analysis: Time series analysis is performed on export and import quantities as well as values for different animal types. This includes using visualization techniques such as line plots to identify trends over the years.

Correlation Analysis: Correlation analysis is conducted to understand the relationships between export/import quantities and values. This helps in identifying factors that may influence the trade of meat animals.

Statistical Analysis: Statistical methods may be applied to validate observed trends, identify significant changes, and assess the overall significance of the findings.

Visualization: Results are visualized using plots and charts to communicate the trends effectively. This step aids in presenting the insights in a comprehensible manner.

How the Approach Addresses the Problem:

The approach addresses the problem by ensuring data cleanliness and consistency, laying a robust foundation for meaningful analyses. Renaming columns contributes to better interpretability, making the datasets more user-friendly. The subsequent steps involve in-depth exploration, visualization, and statistical analyses to derive insights into trends, patterns, and potential correlations within the meat animals import and export business.

About the dataset:

In this project, the FAOSTAT historical dataset which can be accessed from Kaggle (Source:https://www.kaggle.com/datasets/unitednations/global-food-agriculture-statistics) will be used. The dataset represent over 200 countries with more than 25 primary products and inputs that were collected in between 1961 to 2013 years. Key variables include in the dataset are Country, Item (Agricult_Products, Cattle, Sheep, Chicken, Crops, etc), Element (Import Quantity, Export Quantity, Import Value, Export Value), Year (1961 – 2013), and Value. The

live Animals component of the FAOSTAT dataset had originally a total of 662958 rows and 11 columns.

A total of 4 datasets (A, B, C, D) were extracted from this big FAOSTAT dataset. The 4 datasets that were extracted offer a detailed perspective on different facets of meat animals trade. Dataset A focuses on export and import quantities, Dataset B delves into export quantities and values, Dataset C provides insights into import quantities and values, and Dataset D encompasses export and import values. These datasets collectively form the basis for my analytical exploration.

The 4 datasets:

Dataset A: 'export_&_import_quantities'

Dataset B: 'export_quantities_&_values'

Dataset C: 'import_quantities_&_values'

Dataset D: 'export_&_import_values'

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The following are the first few rows of each of the 4 datasets:

Dataset A: export_&_import_quantities

The first few rows of the dataset (A):

Area	Item	Element	Year	Unit	Value
Australia	Cattle	Export Quantity	1996	Head	1161930
Australia	Cattle	Export Quantity	1997	Head	1530584
Australia	Sheep	Export Quantity	1974	Head	1060464
Australia	Sheep	Export Quantity	1975	Head	1448935
Australia	Sheep	Export Quantity	1976	Head	1844856
Belgium	Pigs	Import Quantity	2008	Head	1235613
Belgium	Pigs	Import Quantity	2009	Head	1451219

Dataset B: export_quantities_&_values

The first few rows of the dataset (B):

Area	Item	Element	Year	Unit	Value
Argentina	Cattle	Export Quantity	1961	Head	171106
Argentina	Cattle	Export Quantity	1962	Head	250274
Argentina	Cattle	Export Quantity	1963	Head	291819
Australia	Cattle	Export Value	1995	1000 US$	160133
Australia	Cattle	Export Value	1996	1000 US$	306484
Australia	Cattle	Export Value	1997	1000 US$	353008
Australia	Cattle	Export Value	1998	1000 US$	184339

Dataset C: import_quantities_&_values

The first few rows of the dataset (C):

area	item	element	year	unit	value
Algeria	Cattle	Import Value	2011	1000 US$	116029
Algeria	Cattle	Import Value	2012	1000 US$	100332
Algeria	Cattle	Import Value	2013	1000 US$	155253
Algeria	Sheep	Import Quantity	1962	Head	160000
Algeria	Sheep	Import Quantity	1963	Head	312000
Algeria	Sheep	Import Quantity	1987	Head	529120

Dataset D: export_&_import_values

The first few rows of the dataset (D):

Area	Item	Element	Year	Unit	Value
Afghanistan	Cattle	Import Value	2012	1000 US$	3090
Afghanistan	Cattle	Import Value	2013	1000 US$	20412
Afghanistan	Chickens	Import Value	2005	1000 US$	2211
Afghanistan	Chickens	Import Value	2006	1000 US$	1855
Albania	Sheep	Export Value	1988	1000 US$	1800

The variables in the dataset are:

'Area' represents country,

'Item' represents type of animals

'Element' represents, either Import Quantity, Export Quantity, Import Value, or Export Value

'Year' represent year of the business

'Unit' represent either heads of animals (for quantities), or (1000 US$) for values

'Value' represent either value in terms of US$ or heads of animals

Original Purpose of the Data:

The original purpose of the FAOSTAT historical dataset is to provide comprehensive global food and agriculture statistics. It covers over 200 countries and includes more than 25 primary products and inputs, collected between 1961 to 2013. The dataset aims to facilitate analysis and understanding of global food and agriculture trends.

Collection Period:

The data spans from 1961 to 2013, encompassing more than five decades of historical information. This extended time frame allows for longitudinal analysis of trends and patterns in meat animals' import and export business.

Number of Variables in the Original Dataset:

The original FAOSTAT dataset had 11 columns, including 'Country,' 'Item,' 'Element,' 'Year,' 'Unit,' and 'Value.' After data cleaning, the extracted datasets (A, B, C, D) used for analysis have 5 columns: 'Area' (renamed as 'country'), 'Item' (renamed as 'animal_type'), 'Element,' 'Year,' and 'Value.'

Peculiarities and Data Quality:

Data Cleaning: The original dataset underwent a data cleaning process to handle issues such as missing values and duplicates.

Dataset Size: The cleaned dataset used for analysis has 494,770 rows and 5 columns.

Unit of Measurement: 'Unit' column represents the measurement unit (e.g., Head, 1000 US$).

By leveraging Kaggle as a source, the datasets benefit from a collaborative platform that hosts diverse datasets and provides a standardized environment for data sharing and analysis. The FAOSTAT dataset, in particular, offers a rich resource for studying global food and agriculture statistics over an extensive time period.

Required Packages:

To facilitate the analysis, I leverage several R packages, including tidyverse, ggplot2, dplyr, tidyr, readr, ggpubr, lubridate, knitr, and kableExtra. These packages collectively empower me with a rich set of tools for data manipulation, visualization, and report generation.

Plots and Table Needs:

The nature of the research questions suggests the need for a diverse set of visualizations and tables. Time series plots, bar plots, heatmaps, and box plots are essential to convey trends, comparisons, and distributions effectively. Additionally, well-formatted tables summarizing key statistics play a crucial role in presenting clear and concise findings.

Questions for Future Steps:

As I progress with the analysis, several questions arise for future steps. These include the exploration of advanced time series analysis techniques, the potential application of statistical models for deeper insights, and the consideration of interactive visualizations to enhance user engagement. Additionally, handling big data efficiently may become a focus if the datasets expand in size.

In summary, this project aims to provide a comprehensive understanding of trends in meat animals import and export, utilizing data science techniques and leveraging the power of R programming and visualization tools. The combination of exploratory data analysis, statistical modeling, and interactive visualization will contribute to uncovering valuable insights in this dynamic global market.

References

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