U.S. Food Imports: Trends and Visualizations (1999–2024)

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2025-12-19

Introduction

Every year, the United States imports billions of dollars worth of food from other countries, to feed its citizens and to resell. The composition of these imports has changed. Over time, it has become a global endeavor with the United States now importing food and related goods from almost every country in the World. The US government keeps a record of the past 20 years of trade data and it is available to the public. That data is what we will be analyzing in this project. The data is neatly divided as a CSV file into different categories, countries, and years to make it easy for data manipulation and calculation. Using this, we will observe how US trade data can be categorized and how it has changed over time.

Data Provenance

Data set title: U.S. Food Imports

Publisher / Data Steward: United States Department of Agriculture, Economic Research Service (ERS)

Source agency of raw data: U.S. Department of Commerce, U.S. Census Bureau trade statistics

Contact person (at ERS): Angelica Williams (as listed on the ERS page)

Collection period: Calendar years covers 20 years

Geographic scope: United States ports and origin countries globally

Last Update: April 11 2025

Data Format: CSV

FAIR and CARE Principles

Our data satisfies both the FAIR and CARE principles of data. Our data is FAIR because it is easily findable and accessible to anybody since it just exists on a government website and can be simply downloaded as a CSV file before being uploaded anywhere. As a CSV file, it is very interoperable; when uploaded into R, we could immediately work on it very easily. The data is also reusable since the government kept records of how the data was kept and stored. For CARE, we use the data to gain insights about the evolving world, which is beneficial to everyone. The data was collected in a way where the US Government (the collector) has authority over it since it is their financial records, and the data was collected from governments that can regulate what is shared. We made sure to use this data ethically and responsibly, not making any judgments or treating different nations unfairly.

Attributes of Interest

The primary attributes that are used in this analysis are from the Food Imports data set:

- **YearNum**: The year that the food was imported.
- **Country**: The source country of the import.
- **Commodity**: The specific food or item group.
- **FoodValue**: The value for the imported food, with the meaning of that value being in the UOM column.
- **UOM** (Unit of Measure): The units that the imported item's value is measured in.

Along with these attributes, several were created to support the visualizations:

- **Percentage_Change**: The percentage that the total food value has changed by since the previous year.
- **proportion**: Each country's share of total U.S. food imports for that given year.
- **TotalVal**: The total import value for each food commodity type.

Exploratory Data Analysis

Overview of the Data set

The U.S. Food Imports Data set, provided by the U. S. Department of Agriculture and Economic Research Service, has the records of the value of food and beverages products imported to the United States. The data spans over the the years of 1999 to 2024.
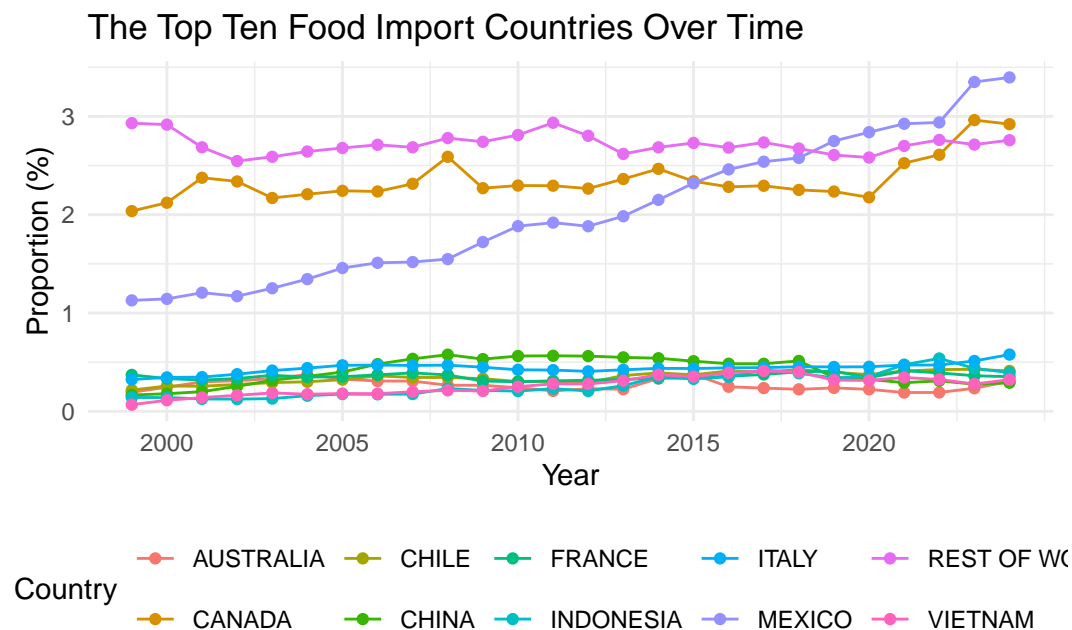
The following are the columns that are structured in a long format table for the data set: - **Commodity**: The specific food or item group (e.g. "Total live animals", "Bovine animals, live", "Swine, live"). - **Country**: The source country of the import (e.g. "CANADA", "MEXICO", "CHINA"). - **UOM** (Unit of Measure): The units that the imported item's value is measured in (e.g. "Million $", "1,000", "1,000 mt"). - **Category**: Broader classifications for the imported item's type (e.g. "Animals", "Fish", "Vegetables"). - **SubCategory**: Broader classifications for the imported

item's value meaning (e.g. "Foods", "Total foods", "Subtotal foods"). - **RowNumber**: An identifier for each row of the table - **YearNum**: The year that the food was imported (e.g. "1999"). - **FoodValue**: The value for the imported food, with the meaning of that value being in the UOM column.

The full data set has 19,838 rows and 8 columns

Key Visualizations and Insights

The Top Ten Food Import Countries Over Time Through the Years 1999 to 2024

The Top Ten Food Import Countries Over Time
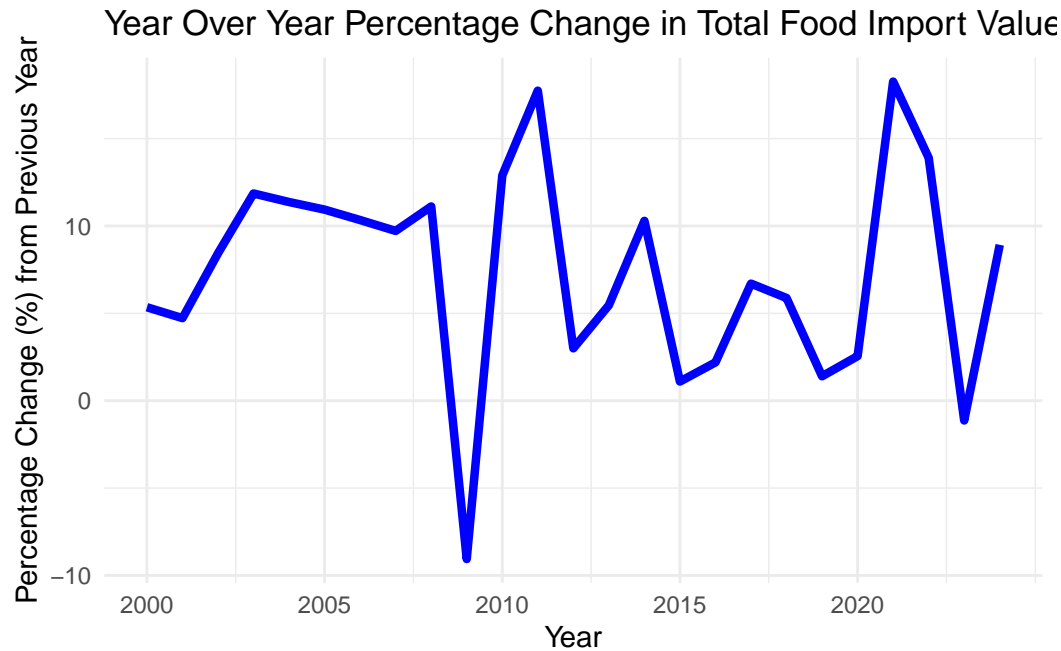
Top 10 Countries Narrative Text

The graph shows the different countries and their proportion percentage that they contribute to the U.S. total import value for that year. The countries: Australia, Chile, France, Italy, China, Indonesia, Mexico, and Vietnam are all apart of the 10 countries with the highest proption percentages, but compared to the top 3 countries they are very low. Each of these countries most years have percentages between 0.1% to 0.6%, with most of them slightly increasing as time goes on. Canada is usually had the either the 2nd or 3rd highest percentage with it starting around 2% in 1999 and until around 2020 staying around the same percentage with only a slight increase through the years, until after 2020, where it began to increase at a relatively fast rateand reaching almost 3% in 2023, and being only slightly less in 2024, and in these final 2 years it reached the second highest percentage. The Rest of World country is not actually a country but all of the countries that were not apart of the original data set but contributed to importing food and beverages to the U.S. It had the highest percentage through most of the years and started at a little less than 3% in 1999, throughout the years this percentage went up and down a bit, between 2.5% and 3%. It really started to decrease after 2011 though and ended with a final percentage of around 2.75%

in 2024 at the 3rd highest percentage. The most interesting country though was definetly Mexico, which started out at a little more than 1% but had a very high increase through the years, reaching 2% in 2013, and then 3% in around 2022, and in 2024 ended with almost 3.5%, leaving it as the highest percentage amoung all countries and having an increase of nearly 2.5% through the years, which is very impressive compared to the rest of the countries.

Year-Over-Year Percentage Change in Total Food Import Value to the US

Table 1: Figure 4: This table shows the percentage changes of the total imported food value to the United States during the years of 2000 to 2024

Year	Percentage_Change
2000	5.350016
2001	4.727062
2002	8.434497
2003	11.860698
2004	11.371576
2005	10.936533
2006	10.340005
2007	9.717278
2008	11.118658
2009	-9.060494
2010	12.895167
2011	17.745712
2012	2.997133
2013	5.466107
2014	10.294432
2015	1.098141
2016	2.194828
2017	6.701168
2018	5.879625
2019	1.400599
2020	2.553731
2021	18.263861
2022	13.902033
2023	-1.129919
2024	8.922860

Year Over Year Percentage Change in Total Food Import Value

Percentage Change Narrative Text

The table and graph show that the percentage change is something that often and has spikes in both the positive and negative direction. In 2000 the percent change from the previous year is around 5%, and this value increases during the following years until 2003. From 2003 until 2009, the value stays pretty constant, being between around 9% and 11%. In 2009 though the percent change value drops all the way to -9%, and this is likely because of the 2008 economic crash which had caused many economic problems and likely was the reason that this large change happened causing the total imported food value to decrease so much from the previous year. After this year, there was a big bounce back with 2010 having around 13% percent change, and almost 18% in 2011. This value though dropped after this and went up and down a little between the years of 2012 until 2021, where it was between the ranges of around 1% and 10%. In 2021 though there was a large spike leading to the largest peak in all of the data at around 18%, and this is likely because of the Covid-19 Pandemic that happened in 2020 which made creating our own food in the U.S. somewhat difficult and leading the U.S. to importing more food from countries which were not shut down. This was also the case in 2022 whch had a high value of almost 14%. This though dropped sharply in 2023 going to around -1%, and then finishing 2024 with a pretty high almost 9%. This data shows that the percent of change value is effected heavily by real world events, specifically those economically related. It also showed that most years the percent change was positive, meaning the U.S. was importing more food in every each year than the last on average.

Top 10 Most Valuable Food Commodity Types Imported into the U.S from Years 1999 to 2024

Table 2: Figure 3: Data set where each case is a Type of Import, listing the Total Food Value that has been imported in Millions of US dollars

Commodity	TotalVal
U.S. imports	2732440.1
Plants	1689694.1
Total fish and shellfish	884407.8
Animals	740777.4
Total fruit and preparations	716941.4
Beverages	603937.2
Total beverages	603937.2
Total vegetables and preparations	534048.4
Fresh or chilled fruit	480165.6
Total grains and products	467009.4

Top 10 Commodity Types Narrative Text

The table shows the relationship between the different food commodities and the total value, in millions of U.S. dollars, for all of the years of 1999 to 2024. The commodity listed with the lowest total value is Total grains and products which starts out at around 467000 million dollars. Fresh or chilled fruit is next with just a little more than the previous at around 480000 million dollars. Total vegetables and preparations are a bit more than the previous with around 534000 million dollars. Then the next commodities are Total beverages and Beverages which is quite a bit of an increase from the previous with both being around 600000 million dollars. The next commodity is an even larger leap with Total fruit and preparations being at 717000 million dollars. Then with a slight increase from that is Animals, with a total value of 740000 million dollars. Total fish and shellfish is a significant increase from the previous at around 884000 million dollars and is the 3rd highest value. Then a 2nd highest value is Plants which is a very large increase and almost doubling the previous with a total value of 1690000 million dollars or 1.69 trillion dollars. Then the highest total value is the U.S. imports which is at 2700000 million dollars or 2.7 billion dollars, which is another very large increase from the previous.

Discussion and Data Story

The analysis of U.S. food imports from 1999 to 2024 reveals several important trends. A small set of countries consistently dominates the U.S. import market, with Mexico and Canada contributing the largest proportions of total imports throughout the years. The top ten importing countries collectively account for the majority of food import values, while other countries have smaller but steady contributions. The year-over-year percentage change shows that total import values are sensitive to major economic events, such as the 2008 financial crisis and the COVID-19 pandemic, which caused noticeable drops and spikes in imports.

Among food commodities, certain types, such as Plants and aggregate U.S. imports, have consistently had the highest total values, indicating that the U.S. relies heavily on a few key commodities.

Mexico's share of imports increased steadily from just over 1% in 1999 to nearly 3.5% in 2024, suggesting growing trade relationships and demand. Canada maintained a strong presence throughout the period, often ranking as the second or third largest contributor, while the "Rest of World" category represents other countries not individually listed, showing relatively consistent contributions.

These patterns highlight potential vulnerabilities in the U.S. food supply. The concentration of imports in a few countries and commodities means that disruptions in these areas could have significant impacts. For example, economic crises, trade restrictions, or global events can substantially affect the total value of imports. The data also illustrates the importance of monitoring trends over time to anticipate shifts in the market and to inform policy decisions.

Overall, this analysis demonstrates that the U.S. food import market is shaped by both international trade dynamics and real-world events. Policymakers and businesses may consider strategies to diversify import sources, strengthen domestic production, or monitor critical commodities to reduce risk. Future work could explore more detailed commodity-level trends, the impact of trade agreements, or the role of global supply chain disruptions on U.S. food imports.

Author Contributions

Luke Shoemaker

Created and did a lot of the work on the qmd file, mainly the structure, some of the paragraphs like the attributes of interest, and overview of the data set parts. Specifically worked on the Year-Over-Year percentage change table and plot, and did a lot of the code for the wrangling as well. Also worked on some of the narrative texts for the visualizations

Brian Schiele

Created most of the data wrangling and created the visualizations for the Top 10 countries visualizations, along with the Top 10 commodity type plots. Wrote the paragraphs for the Introduction, Data Provenance, and FAIR and CARE principles. Also did a bit of reviewing the document and reviewing the final code chunks.

Bonnie Wang

Was a big contributor in the narrative texts for the visualizations, while also writing the Discussion and Data Story section which described the whole data set and what it showed. Also was a big contributor by reviewing all of the code chunks to make sure there were no errors, and also reviewed the whole document to make sure all points on rubric would be met.

References

Code Appendix

```r
library(ggplot2)
library(tidyr)
library(dplyr)
library(readr)
library(knitr)
library(scales)

foodraw = read.csv("FoodImports.csv")
FoodImports = read.csv("FoodImports.csv")

#Wrangling dataset
food_imports_country <- FoodImports %>%
  filter(UOM == 'Million $' & Country != 'WORLD') %>%
  group_by(Country,YearNum) %>%
  summarize(total_imports = sum(FoodValue))

food_imports_yearly <- FoodImports %>%
  filter(YearNum != 'means' & YearNum != 'means10years') %>%
  group_by(YearNum) %>%
  summarize(yearly_imports = sum(FoodValue))

food_imports_prop <- food_imports_country %>%
  left_join(food_imports_yearly, by = 'YearNum') %>%
  mutate(proportion = (total_imports/yearly_imports) * 100)

top_ten_countries <- food_imports_prop %>%
  group_by(Country) %>%
  summarise(avg = mean(proportion)) %>%
  arrange(desc(avg)) %>%
  mutate(avg = percent(avg/100))

top_ten <- top_ten_countries$Country[1:10]

food_imports_prop_graph_data <- food_imports_prop %>%
  filter(Country %in% top_ten) %>%
  mutate(year = as.numeric(YearNum))

foods <- foodraw %>%
  # Filter out all cases that have unwanted values
  filter(!Country %in% c("REST OF WORLD", "WORLD", "WORLD (Quantity)")) %>%
  filter(UOM %in% c("1000", "Million $")) %>%
  filter(!Category %in% c("Food dollars", "Food volume", "Prices")) %>%
```
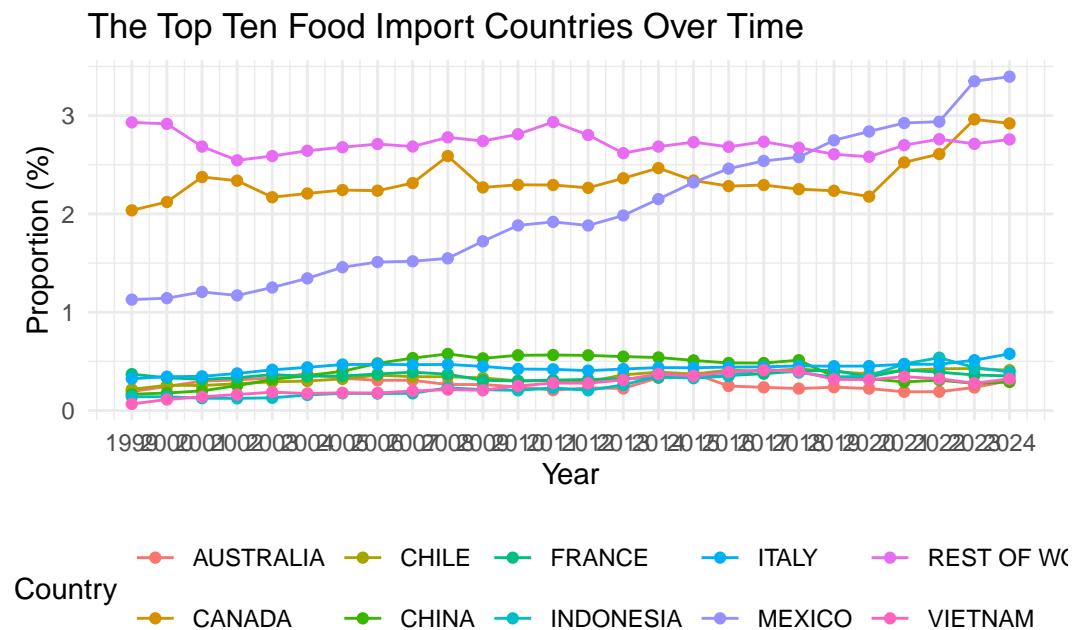
```r
  filter(SubCategory == "Foods") %>%
  filter(!YearNum %in% c("means", "means10years")) %>%
  # Multiply 1000 to FoodValue value if UOM value is 1000 or multiply by 1000000 if  UOM value
  mutate(FoodValue = FoodValue * ifelse(UOM == "1000", 1000, 1000000)) %>%
  select(-UOM, -RowNumber, -SubCategory) %>%
  rename(Year = YearNum)

ggplot(
  food_imports_prop_graph_data,
  aes(x = year, y = proportion, group = Country, color = Country)
) +
  geom_line() +
  geom_point() +
  #scale_y_continuous(labels = +
  scale_x_continuous(breaks = sort(unique(food_imports_prop_graph_data$year))) +
  labs(
    title = "The Top Ten Food Import Countries Over Time",
    x = "Year",
    y = "Proportion (%)",
    color = "Country"
  ) +
  theme_minimal() +
  theme(legend.position = "bottom")
```


The Top Ten Food Import Countries Over Time

```r
foodtotals <- foods %>%
  group_by(Year) %>%
  summarise(
```

```
    value_total = sum(FoodValue)
  ) %>%
  arrange(Year)

foodchanges <- foodtotals %>%
  mutate(value_previous = lag(value_total),
         percent_change = (((value_total - value_previous) / value_previous) * 100)
  ) %>%
  filter(!is.na(percent_change)) %>%
  mutate(Year = as.numeric(Year)) %>%
  rename(Percentage_Change = percent_change) %>%
  select(Year, Percentage_Change)

kable(foodchanges, caption = "Figure 4: This table shows the percentage changes of the total in

ggplot(foodchanges, aes(x = Year, y = Percentage_Change, group = 1)) +
  geom_line(color = "blue", linewidth = 1.5) +
  scale_x_continuous(breaks = seq(2000, 2024, by = 5)) +
  scale_color_brewer(palette = "Dark2") +
  labs(
    title = "Year Over Year Percentage Change in Total Food Import Value",
    x = "Year",
    y = "Percentage Change (%) from Previous Year",
    alt = "The graph shows that the percentage changes from most years were increasing, most ye
  ) +
  theme_minimal()
```